HIGHLIGHTS

REVISION NO. 33 Jun 01/10

Pages which have been revised are outlined below, together with the Highlights of the Revision

CH/SE/SU C PAGES	REASON FOR CHANGE	EFFECTIVITY
CHAPTER 75		
L.E.P. 1- 2	Revised to Reflect this revision indicating new,revised, and/or deleted pages	
75-31-08	Minor additions and amplification	
401- 402	REVISED REMOVAL/INSTALLATION PROCEDURE AND CORRECTED TORQUE VALUE FOR INSTALLATION OF THE NUT THAT SECURES THE VSV ACTUATOR TO THE MOUNTING BRACKET.	

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CHAPTER 75

AIR

LIST OF EFFECTIVE PAGES

N, R or D indicates pages which are New, Revised or Deleted respectively
Remove and insert the affected pages and complete the Record of Revisions and the Record of Temporary Revisions as necessary

CH/SE/SU	C	PAGE	DATE
RECORD			
OF TEMP.			
REVISION			
L.E.P.	R	1- 2	Jun01/10
T. of C.		1	Jun01/08
T. of C.		2	Jun01/08
75-00-00		1	Jun01/04
75-00-00		2	Jun01/04
75-00-00		3	Jun01/04
75-00-00		4	Jun01/04
75-00-00		5	Jun01/04
75-00-00		6	Jun01/04
75-00-00		7	Jun01/04
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75-00-00		11	Jun01/04
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CHAPTER 75

AIR

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AIR - GENERAL - DESCRIPTION AND OPERATION

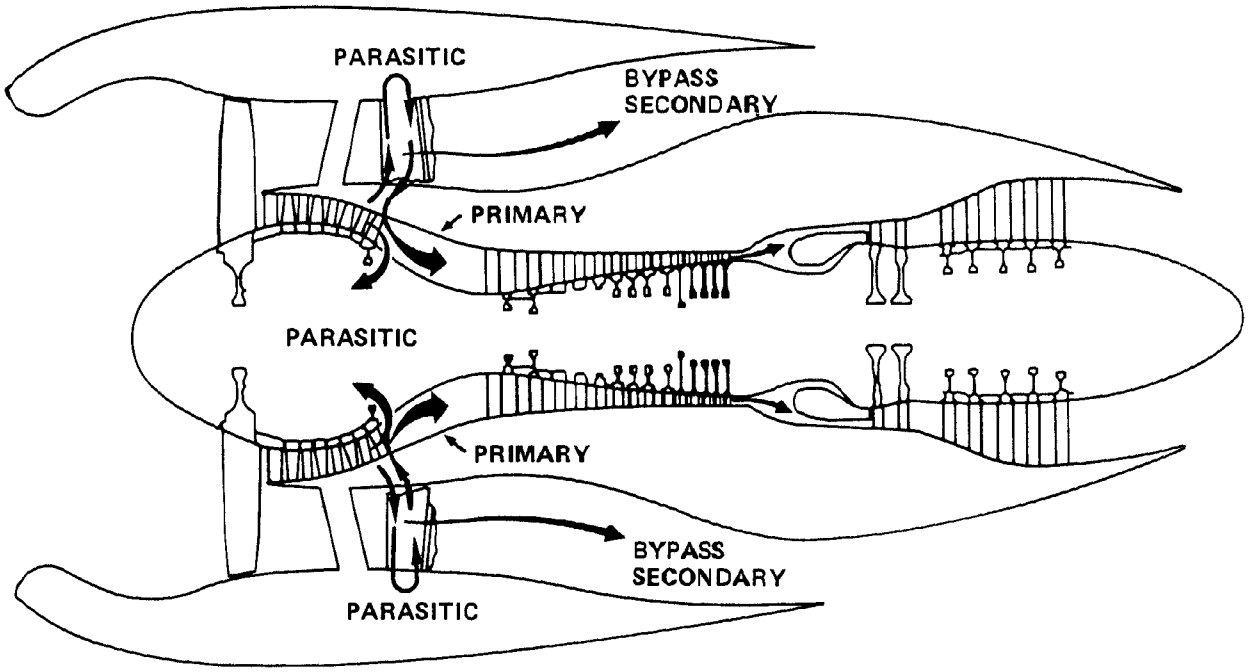
1. General
The air system covers primary, secondary (bypass), and parasitic (cooling and pressurizing) airflows and the systems used to control airflow.

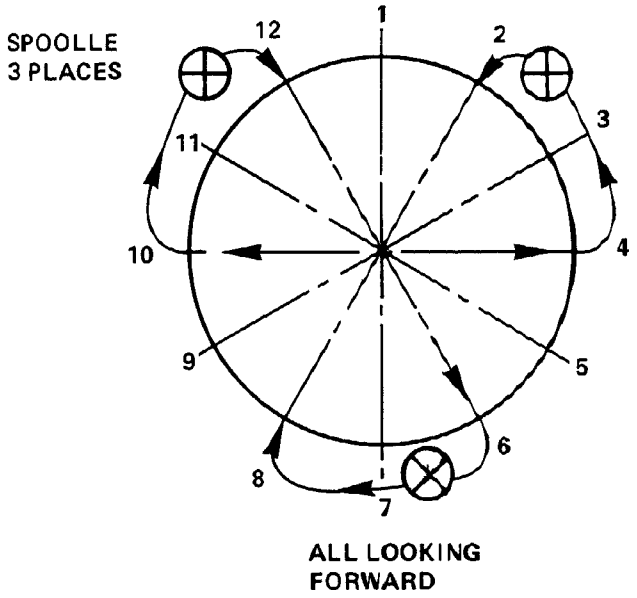
2. Description
(Ref. Fig. 001)
(Ref. Fig. 002)
All engine air enters through the inlet cowl into the front mounted fan. After being compressed by the fan, the airflow is divided by the flow splitter into primary and bypass air flows.

A. Bypass Airflow
Bypass air is discharged through the fan exit nozzle during forward thrust operation and provides the major portion of engine thrust. When the thrust reverser is deployed, the fan exit nozzle is blocked and the bypass air is directed outward at a forward angle through the reverser cascades to provide reverse thrust (Ref. chap. 78). At low power settings, some of the fan discharge air may be primary airflow diverted through bypass valves located in the fan frame. A small portion of the bypass air is used for core engine compartment cooling and for turbine active clearance control cooling at cruise conditions. Bypass air is about 4/5 of the total airflow of the engine.

B. Primary Airflow (Ref. Fig. 003)
(1)Primary airflow is that air which enters the engine near the fan rotor hub and is separated inward by the flow splitter. It passes through the low pressure compressor (booster) and into the core engine. The primary airflow is used to generate the high pressure gas that drives the low pressure turbine.

C. Cooling And Pressurising Airflow
A small amount of air is diverted from the main engine flows to produce sump pressurizing air, rotor spool cavity cooling, blade and vane cooling, case cooling or clearance control, rotor pressure balance piston pressurization and component or accessory cooling. Stage 7HP compressor bleed air is ducted to ports at the forward end of the LPT stator case. The air is ducted to the stage 1 LPT vanes, which contain air passage tubes to direct air to the HPT stage 2 disk aft cavity and LPT stage 1 and stage 2 disk cavity. There are 2 air ducts ; one on each side of the engine. The left hand duct (aft looking forward) branches into 6 tubes while the right hand duct branches into 7 tubes. The 13 tubes connect to the LPT stage 1 vanes at the forward end of the LPT stator case.





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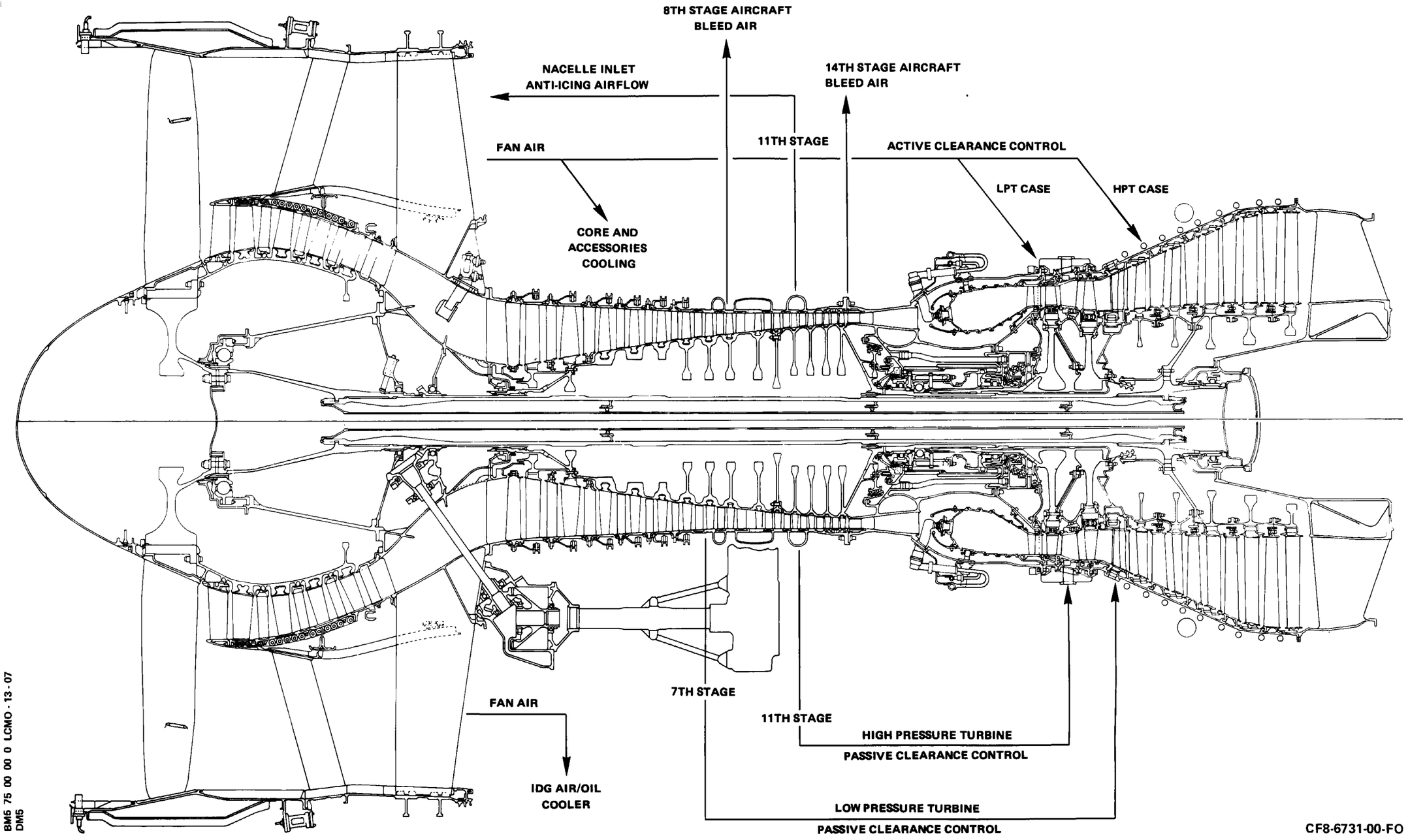
Engine Airflow
Figure 001



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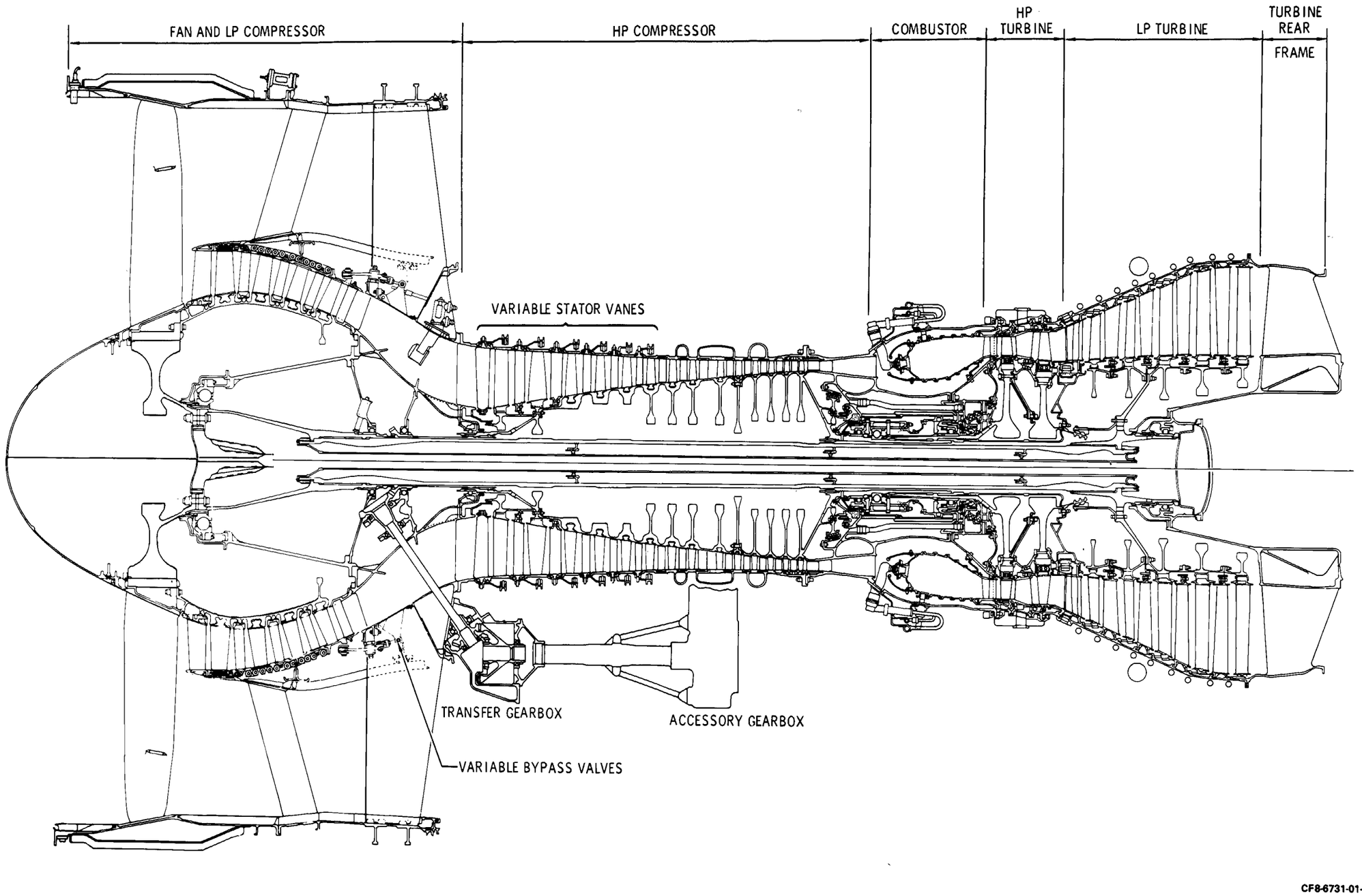
Engine Airflow
Figure 002



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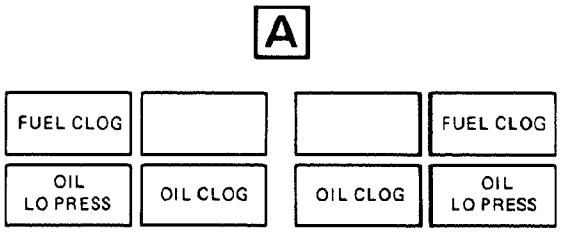
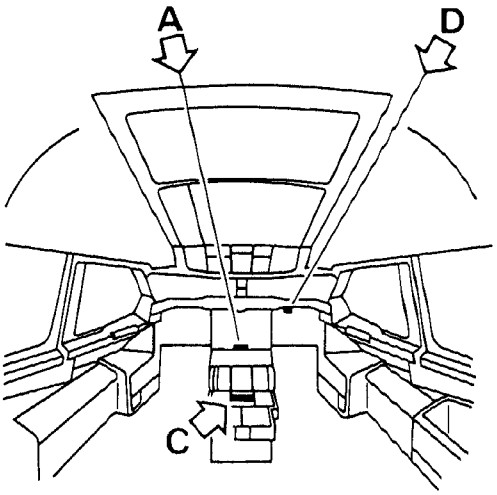
VSV and VBV System
Figure 003

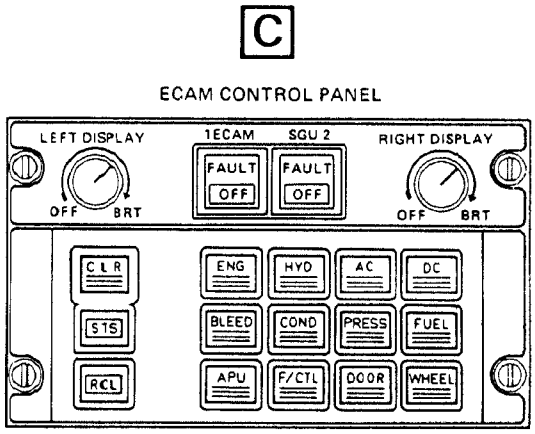
3. Controls and Indications - Component Location
   (Ref. Fig. 004)

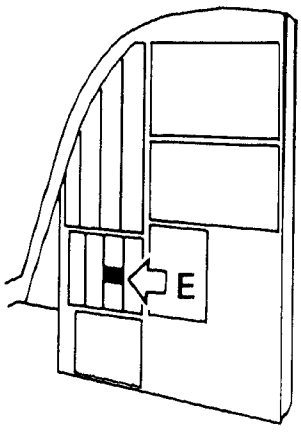
4. Electrical Supply
   (Ref. Fig. 005)

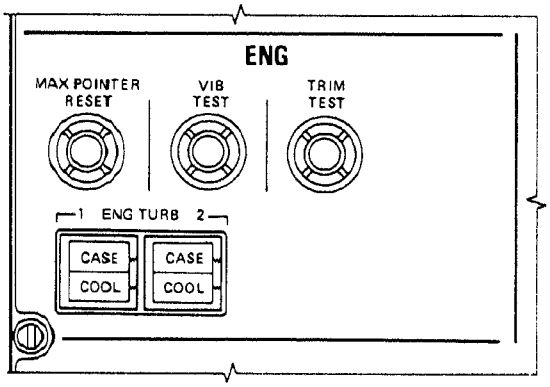
5. Control and Indicating
   (Ref. Fig. 006)
   (Ref. Fig. 007)











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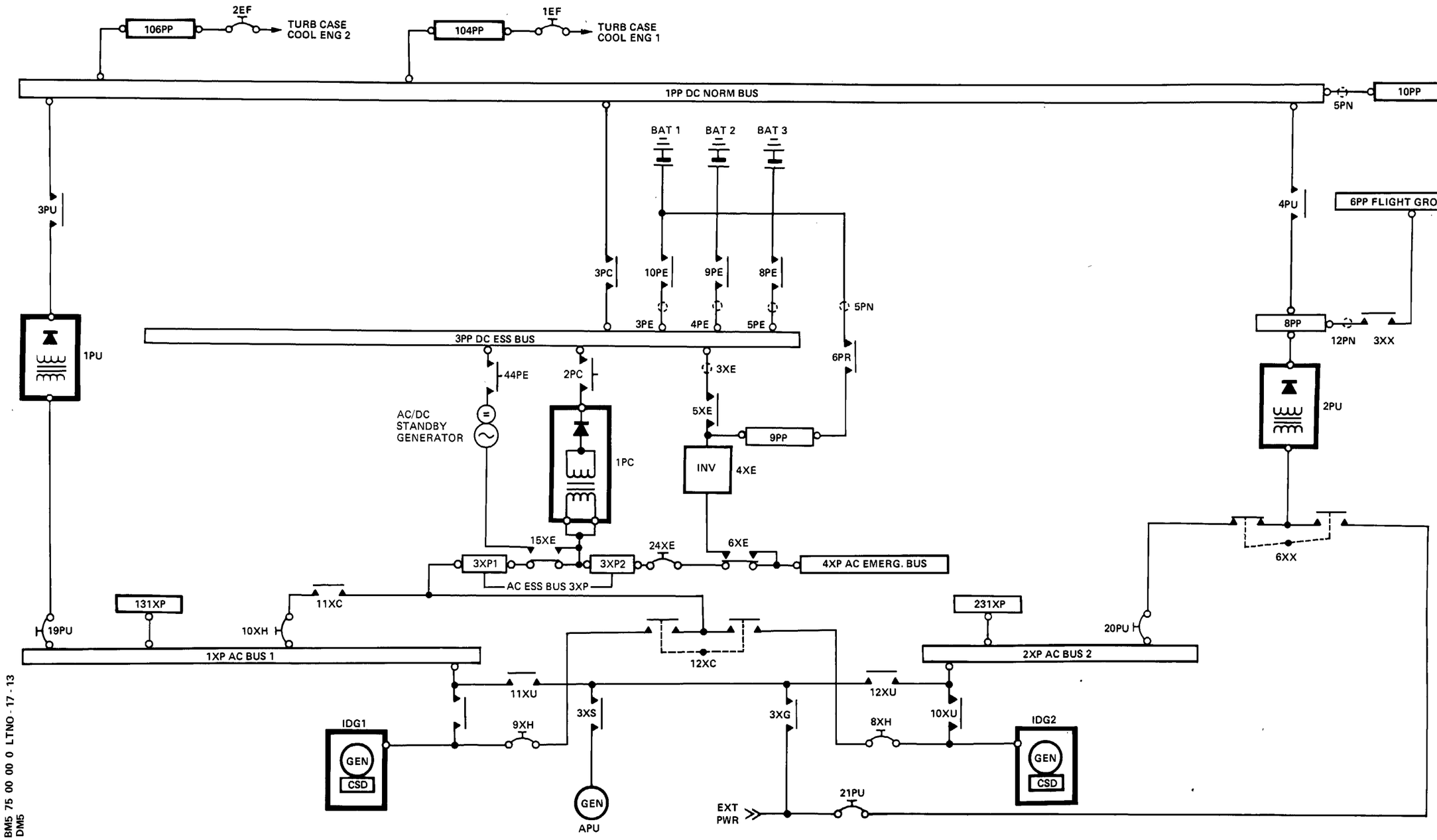
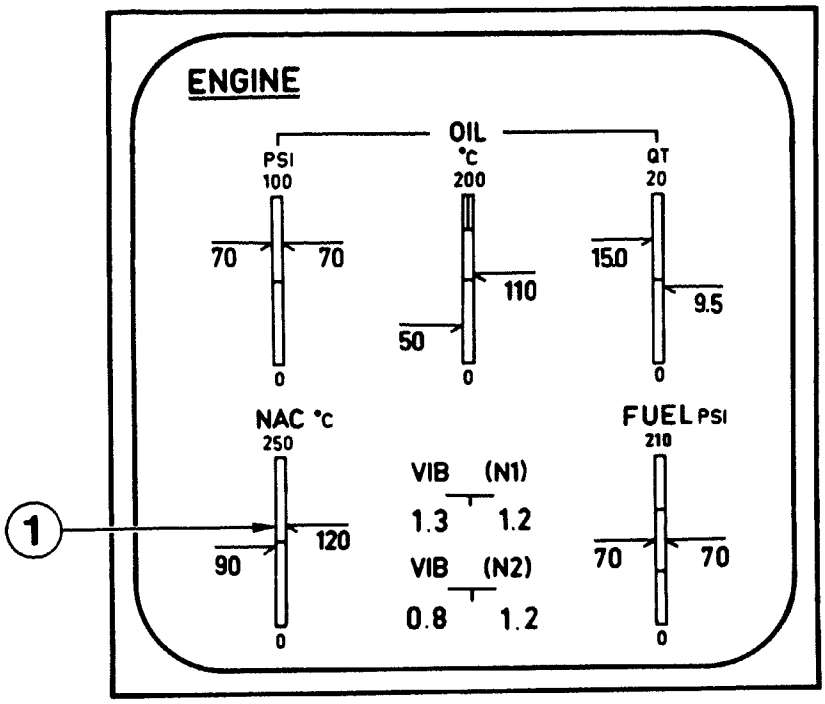
Component Location - Controls
Figure 004



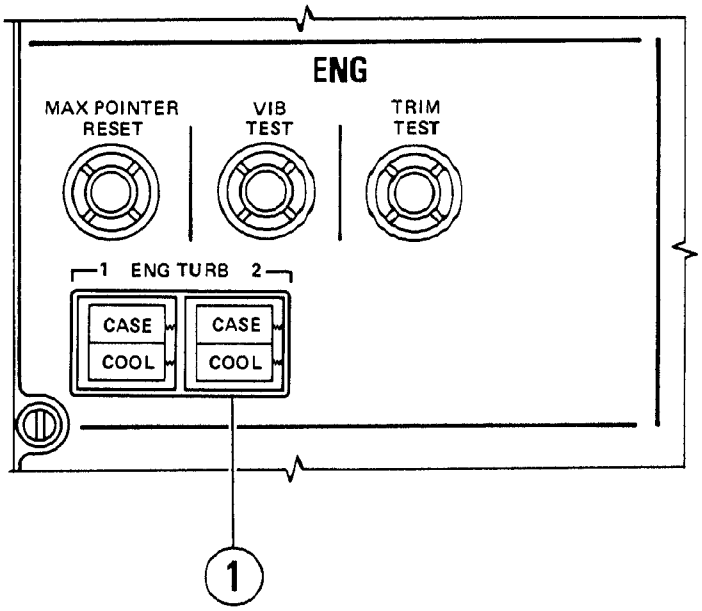
Air in Electrical System
Figure 005



1. NACELLE TEMPERATURE INDICATION FLASHES GREEN
WHEN T > 185°C +TAT
* DURING ENGINE START REPLACED BY BLEED PRESSURE.

BMS 75 00 00 0 LVMO 14 09
DMS

Engine Page on R ECAM Display Unit
Nacelle Temperature Indications
Figure 006



1. TURB CASE COOL WARNING LIGHT (AMBER) COMES ON WHEN FAULT OCCURS IN TURBINE CASE COOLING SYSTEM.

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TURB CASE COOL Warning Light
Figure 007

B/C SUMP PRESSURIZATION SYSTEM INSPECTION/CHECK

1. General

The procedure that follows covers the visual inspection of the B/C sump pressurization system.

2. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
Referenced Procedures - 71-13-00, P. Block 301	Cowl Doors

3. Procedure

A. Job Set-up

(1)Open, safety, and tag the appropriate circuit breakers and open the fan and thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).

(2)Install the access platform.

B. Inspection/Check

Visually inspect the following :

INSPECTION/CHECK	MAX. SERVICEABLE LIMITS	REMARKS
(1)Cushion clamps for :		
(a)Cracks	Any amount if clamp is not broken	Replace clamp
(b)Wear on cushion	Any amount if clamp will securely hold the tube	Replace clamp
(2)B/C sump pressurization tube for :		
(a)Splits or cracks	Not serviceable	Replace air tube
(b)Dents or flat areas	Any amount if deviation does not exceed 20 percent of original tube OD	Replace air tube
(c)Nicks or scores in straight sections	Max. depth not to exceed 0.005 in. (0.1269 mm)	Replace air tube
(d)Nicks or scores in bend section	Not serviceable	Replace air tube
(e)Leakage at attaching flanges	Not serviceable	Tighten attaching hardware or replace seal gaskets
(3)Air tube integral brackets for :		
(a)cracks in attaching weld	Not serviceable	Replace air tube
(b)Wear	Any amount if depth does not exceed 10 percent bracket thickness in area	Replace air tube

INSPECTION/CHECK	MAX. SERVICEABLE LIMITS	REMARKS
	of bolt holes	
(c)Deformation	Any amount if bracket is not broken and attaching weld is not cracked	Replace air tube

C. Close-up
(1)Make sure that the working area is clean and clear of tools and miscellaneous items of equipment.
(2)Remove the access platform.
(3)Remove the safety clips and tags and close the circuit breakers. Close the thrust reverser and fan cowl doors (Ref. 71-13-00, P. Block 301).

BORE COOLING SYSTEM - DESCRIPTION AND OPERATION

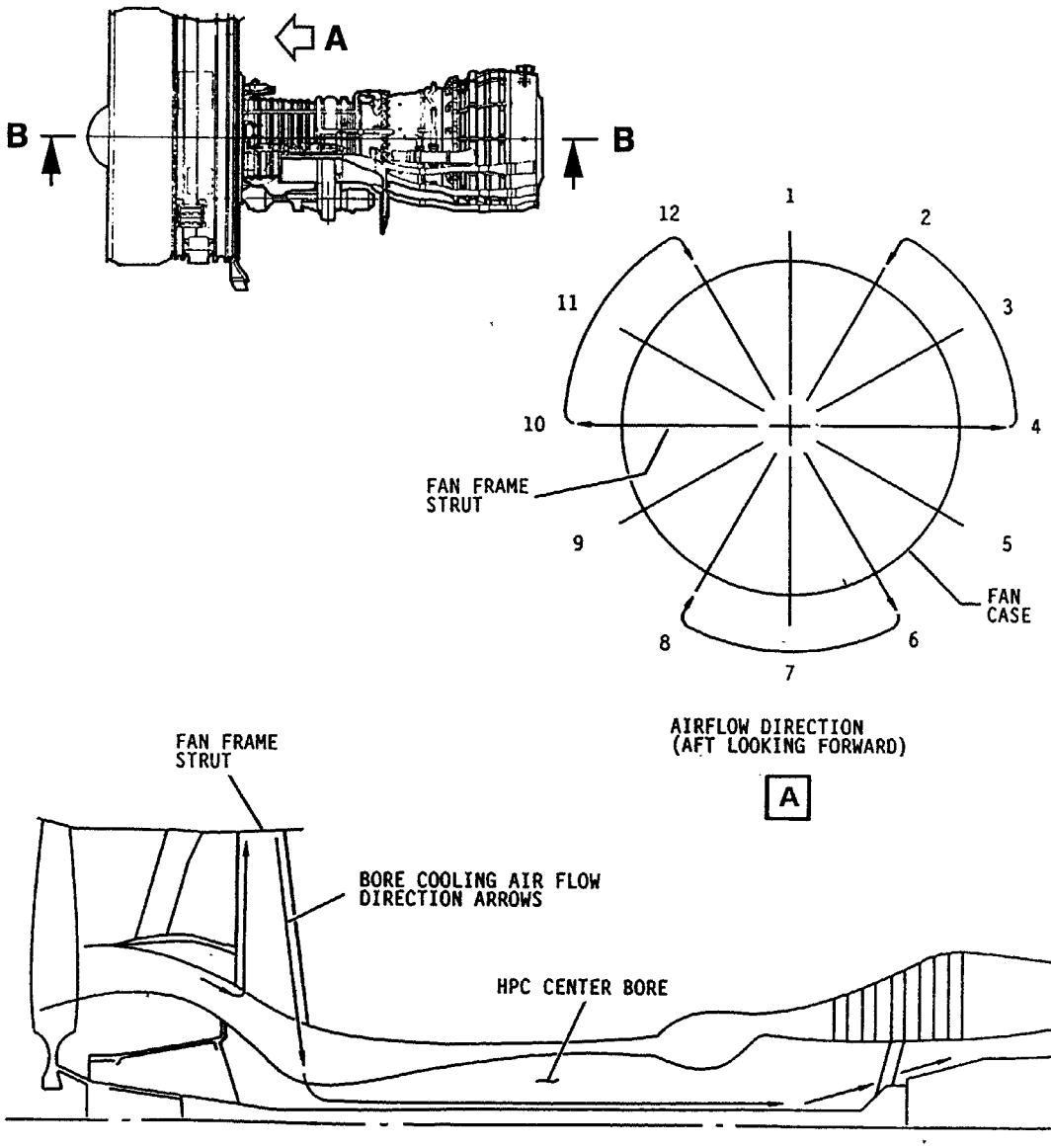
1. General

The function of the bore cooling system is to supply cooling air to the high pressure compressor (HPC) disks. This controls compressor blade tip clearances which helps specific fuel consumption.

2. HPC Bore Cooling (Ref. Fig. 001)

The airflow is continuous through the bore and is not controlled through any valves. Air is removed from the main engine flow at the leading edge of three fan frame struts (Nos. 4,6 and 10) and goes to tubes located on the outboard side of the fan frame. The air then goes into a different fan frame strut. This air flows internally in the frame to an area between the No. 3 seals, and then into the compressor bore center. Air is also removed at the No. 1 and 9 struts and flows radially in directly through the area between the No. 3 seals.

Most of the airflow hits and cools the compressor disks. The air continues through the compressor bore and is put back into the main engine flow at the rear of the engine. The quantity of cooling air is directly controlled by the engine speed.



SECTION B-B

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HPC Bore Cooling System
Figure 001

ACCESSORY COOLING - DESCRIPTION AND OPERATION

1. General (Ref. Fig. 001)

The nacelle is divided into five compartments :
- Inlet compartment
- Fan compartment
- Core compartment
- Fan reverser compartment
- Exhaust nozzle compartment

The inlet compartment is the air space between the nose cowl inner barrel and the cowl's outer surface. During inlet anti-icing, air from the compressor (11th stage) passes through this compartment to a fixed vent at the bottom. (Ref. Fig. 001)

The core compartment is designated as a fire zone and is fire sealed.

The core compartment is cooled and ventilated by air taken from the booster bypass chamber. Air passes throughout the compartment and exits through a vent below the accessory gearbox, and through an annular slot along the lower 270° of the core cowl trailing edge.

The core compartment and the turbine case cooling system share the cooling air source.

The fan reverser compartment is the space between the fan duct outer surface and the nacelle slip stream surface. It is a relatively dead air space around the reverser cascades until the reverser is used, then the compartment becomes the exhaust path for reversal airflow. The exhaust nozzle compartment is a small air space in the outboard structure of the primary exhaust nozzle. It is ventilated by seepage of air through the exhaust nozzle inner skin. All air exhausts along with the main core airflow at the nozzle's trailing edge.

2. IDG Cooling

(Ref. 24-11-00, P. Block 1)

3. Turbine Case Cooling

A. Active Clearance Control System (Ref. Fig. 002, 003)

The system provides fan discharge air for cooling the core compartment at high power settings and the HPT/LPT turbine cases at cruise conditions.

(1) By means of a Y manifold and 3 valves, (1 compartment cooling valve and 2 case cooling valves) cooling air can be selectively directed to the core compartment or to the turbine cases. The valves are not positively shut, but permit a required minimum flow at all conditions and when activated, added flow is directed. ALL (3) valves are actuated simultaneously using stage 11 air pressure. The actuating is regulated by a common "gating" valve that obtains a hydraulic signal from the Main Engine Control. The control utilizes input of atmospheric pressure and engine core speed to send a signal for valve actuation when altitude is above 20,000 ± 4000 feet and core rotor actual speed is between 8009 ± 74 and 9640 ± 74 RPH.

(2) Increased active clearance control airflow causes the cases to cool and shrink. This shrinkage closes blade tip to shroud clearances producing improved efficiency.

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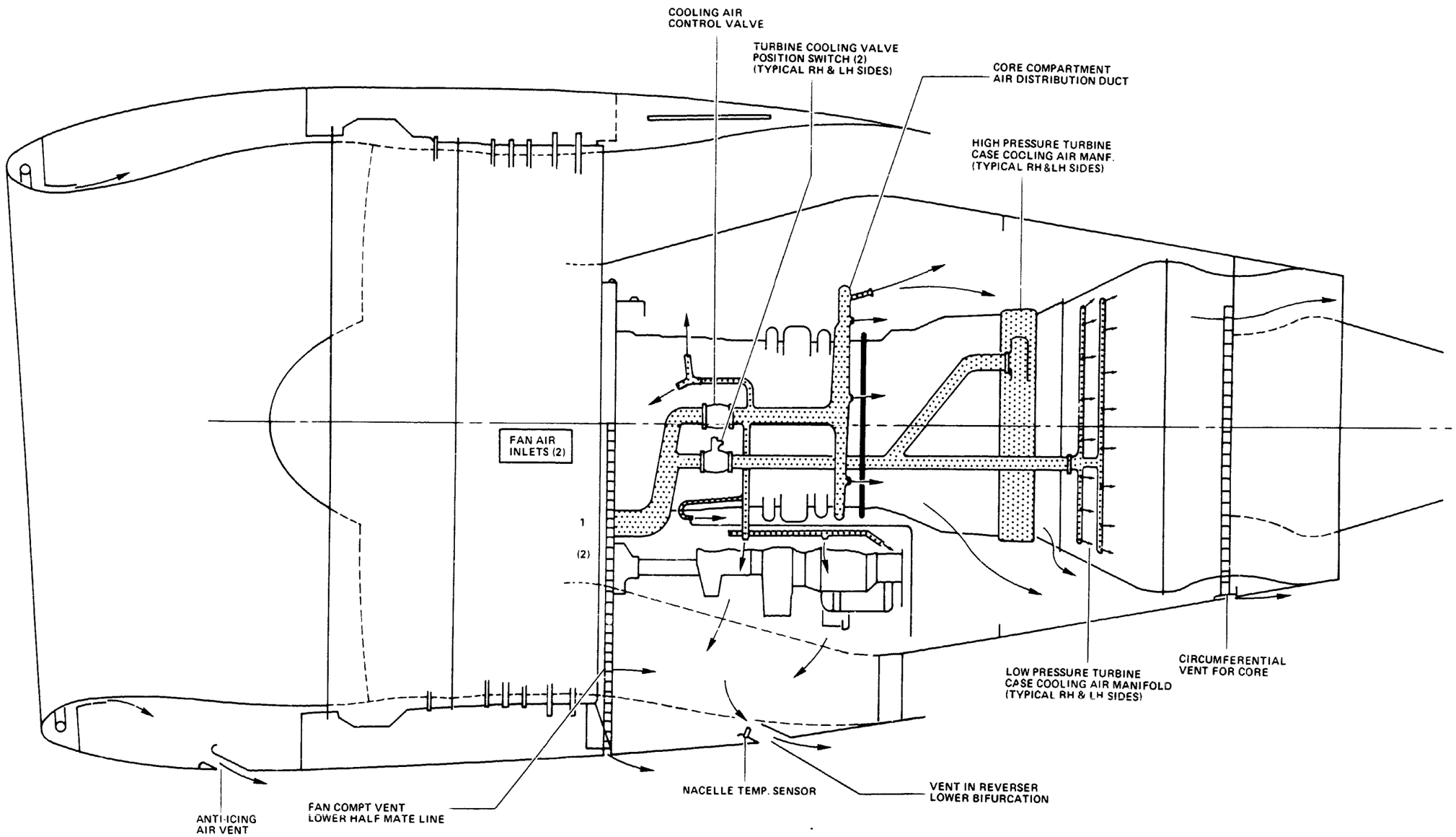

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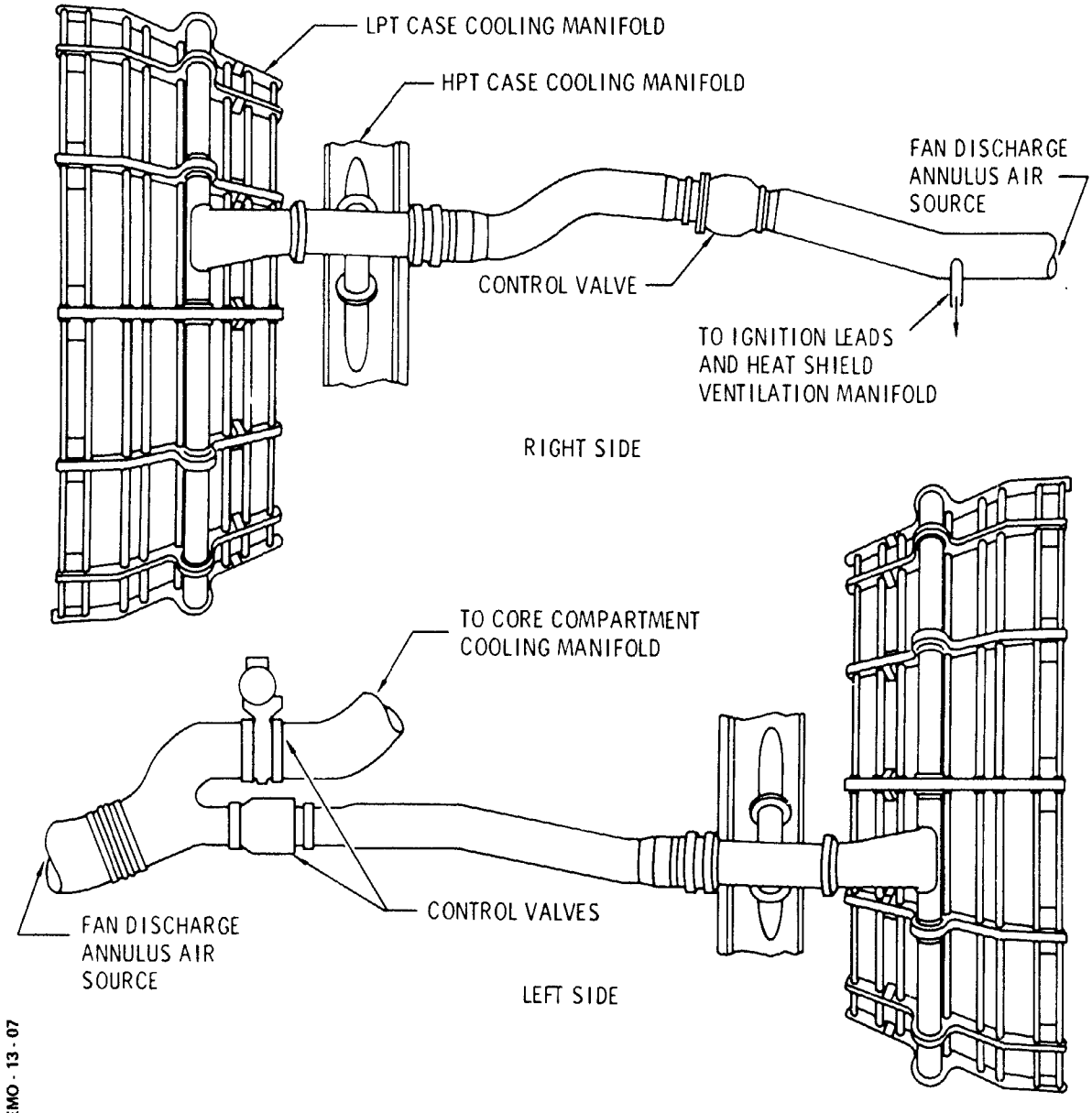
Nacelle Cooling and Ventilation
Figure 001

B. Core Compartment Cooling Valve and HP/LP Turbine Case Cooling Valves
(Ref. Fig. 004)
The core compartment cooling valve, which is part of the active cooling air system, is located at approximately 9 o'clock on the high pressure compressor case, downstream of the Y in the cooling air manifold. The (2) HP/LP ACC valves are located on each side of the engine, one at approximatively 9 o'clock (underneath the core compartment cooling valve), the other one at approximately 2 o'clock.

C. ACC Gate Valve (Ref. Fig. 003)
It is basically a two way valve hydraulically controlled by the MEC.

4. Electrical Circuit
(Ref. Fig. 005)
When the ACC valves actual position differ from the aircraft configuration (altitude core speed) associated warnings appear in the flight compartment.



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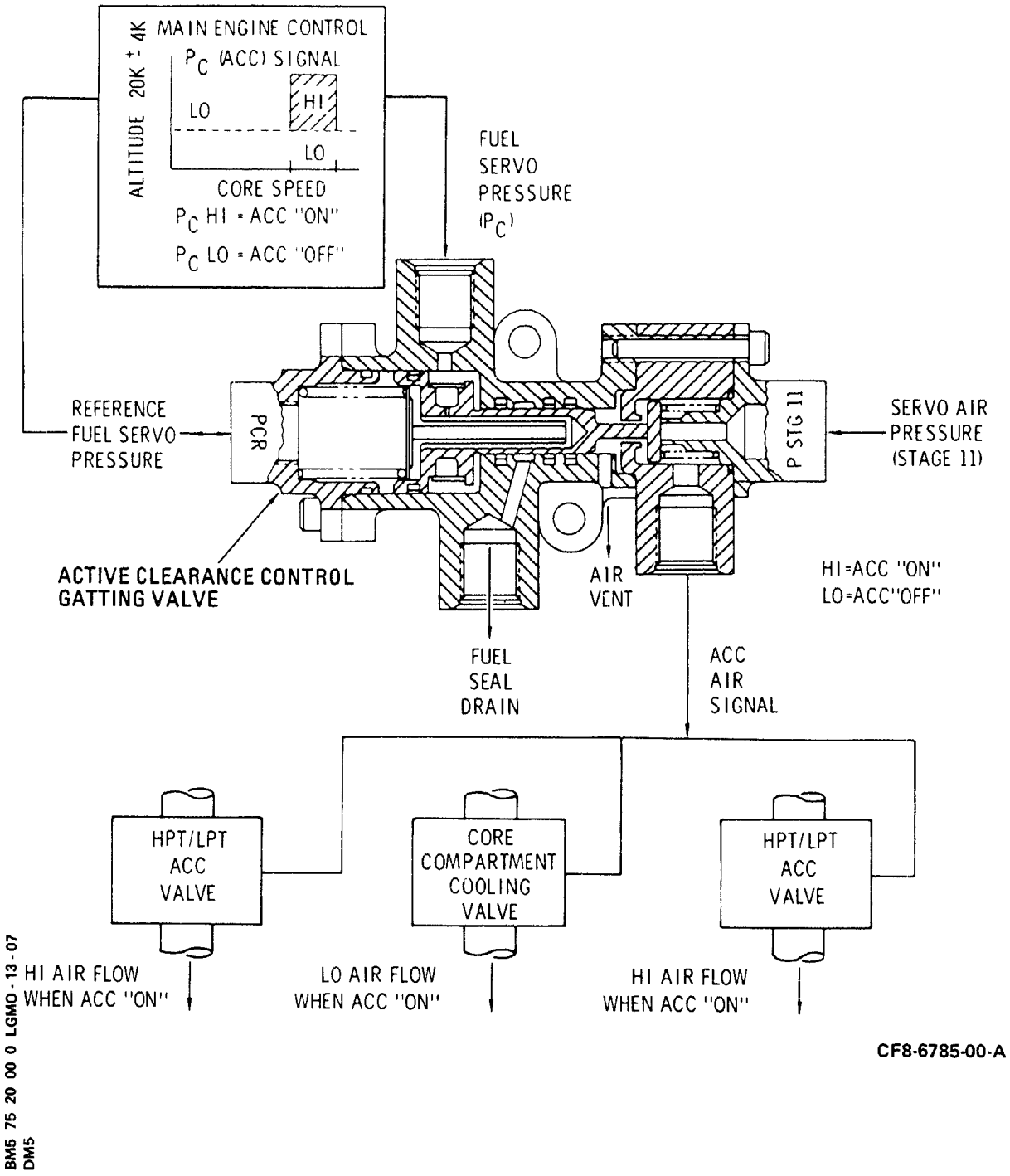
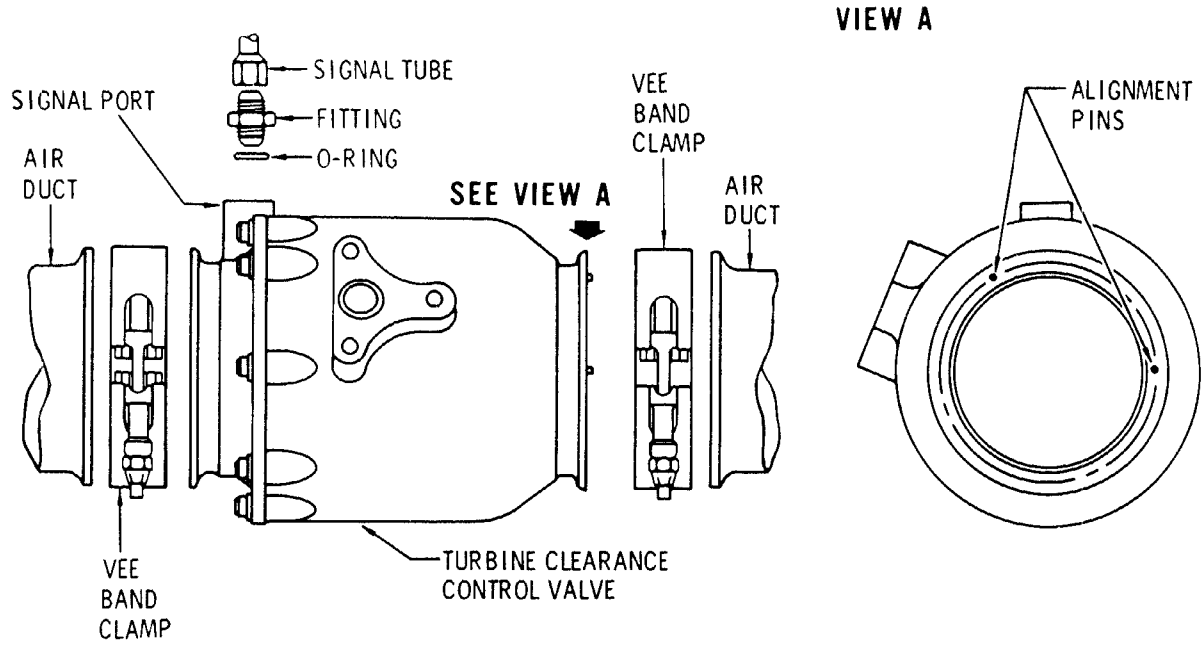
Active Clearance Control
Figure 002



Active Clearance Control (ACC) Signal - Schematic
Figure 003



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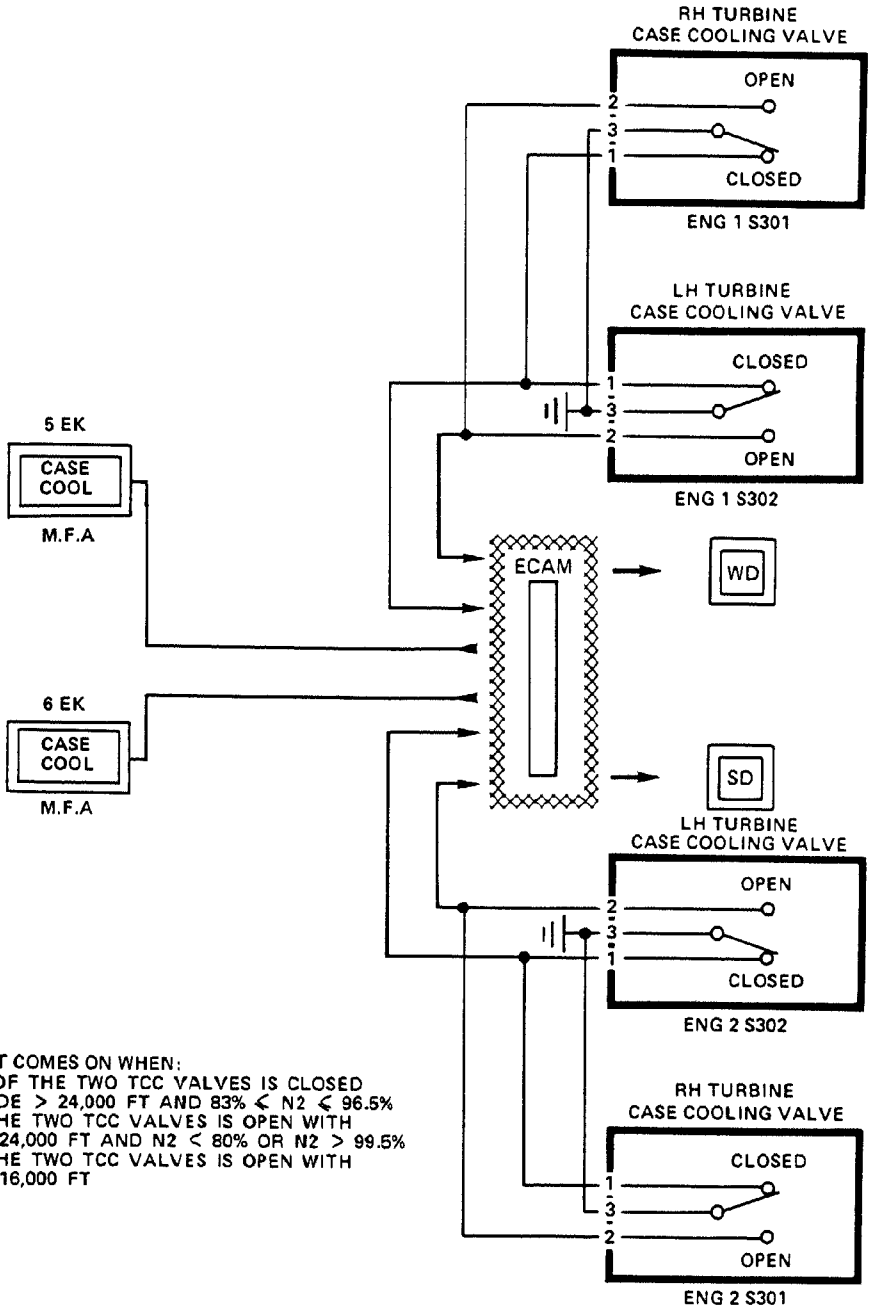
Cooling Air Valves
Figure 004



NOTE : WARNING LIGHT COMES ON WHEN:
- EITHER ONE OF THE TWO TCC VALVES IS CLOSED WITH ALTITUDE > 24,000 FT AND 83% ≤ N2 ≤ 96.5%
- OR ONE OF THE TWO TCC VALVES IS OPEN WITH ALTITUDE > 24,000 FT AND N2 < 80% OR N2 > 99.5%
- OR ONE OF THE TWO TCC VALVES IS OPEN WITH ALTITUDE < 16,000 FT

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Turbine Case Cool Turbine Warning - Electrical Circuit
Figure 005

IGNITION COOLING SYSTEM - INSPECTION/CHECK

1. General

The procedure that follows covers the visual inspection of the ignition cooling system.

2. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
Referenced Procedures	
- 71-13-00, P. Block 301	Cowl Doors
- 74-21-01, P. Block 601	Ignition Leads

3. Procedure

A. Job Set-up

(1)Open, safety, and tag the appropriate circuit breakers and open the fan and thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).

(2)Install the access platform.

B. Inspection/Check

Visually inspect the following :

INSPECTION/CHECK	MAX. SERVICEABLE LIMITS	REMARKS
(1)Hose clamps for :		
(a)Looseness	Not serviceable	Tighteen or replace clamp
(b)Broken	Not serviceable	Replace clamp
(2)Flexible joints for :		
(a)Leakage at manifold connections	Not serviceable	Tighten or replace clamp or replace flexible joint
(b)Holes or tears	Not serviceable	Replace flexible joint
(3)Cooling air manifold for :		
(a)cracks	Not serviceable	Replace cooling air manifold
(b)Dents or flat areas	Any amount if deviation does not exceed 20 percent of original manifold OD	Replace cooling air manifold
(c)Nicks or scores	Max. depth not to exceed 0.005 in. (0.1269 mm)	Replace cooling air manifold
(4)Cooling jacket of the ignition lead		(Ref. 74-21-01, P. Block 601)
(5)Cooling air shroud		(Ref. 74-21-01, P. Block 601)

C. Close-up

(1)Make sure that the working area is clean and clear of tools and miscellaneous items of equipment.

(2)Remove the access platform.

(3)Remove the safety clips and tags and close the circuit breakers. Close the thrust reverser and fan cowl doors (Ref. 71-13-00, P. Block 301).

TURBINE CASE COOLING - DEACTIVATION/REACTIVATION

Ref. : MMEL SECTION 1-75, ITEM 1

1. Reason for the Job

A. Failure of Turbine Case Cooling System

2. Equipment and Materials

ITEM	DESIGNATION
A.	Warning Notice
B.	Circuit Breakers Safety Clips
C.	Blanking Cap
Referenced Procedure - 71-13-00, P. Block 301	Cowl Doors

3. Deactivation

A. Job Set-Up
(1)Open, safety and tag circuit breakers for the appropriate engine and open the fan cowl and thrust reverser doors (Ref. 71-13-00; P. Block 301).

B. Procedure
(1)Disconnect connectors on low pressure and high pressure turbine cooling valves left and right.
(a)Install blanking caps and stow the connectors.
(2)Remove the signal air pressure tubes between the low pressure and high pressure cooling valves, left and right, and the ACC signal valve.
(a)Cap open fittings at the cooling valves and the ACC signal valve.
(3)Install a warning notice in Flight compartment to warn the crew.

C. Close-Up
(1)Close thrust reverser and fan cowl doors, remove safety clips and tags and close circuit breakers (Ref. 71-13-00, P. Block 301).

4. Reactivation

A. Job Set-Up
(1)Open, safety and tag circuit breakers for the appropriate engine and open the fan cowl and thrust reverser doors (Ref. 71-13-00, P. Block 301).

B. Procedure
(1)Remove blanking caps.
(2)Connect connectors.
(3)Install signal tube.
(a)TORQUE B-nut fitting at ACC signal valve to between 270 and 300 lbf.in. (3.05 and 3.39 m.daN) and wirelock.
(b)TORQUE B-nut fitting at the cooling valves to between 270 and

300 lbf.in. (3.05 and 3.39 m.daN).

(4)Apply TSM procedure (Ref. TSM 71-00-00 and 75-23-00).

(5)Remove warning notice from flight compartment.

C. Close-Up

(1)Close thrust reverser and fan cowl doors, remove safety clips and tags and close circuit breakers (Ref. 71-13-00, P. Block 301).

LPT CLEARANCE CONTROL VALVE - REMOVAL/INSTALLATION

1. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Protective Caps
C.	Torque Wrench
D. Material No.C02-033	Anti-Seize Compounds, Lubricants, Oils (Ref. 70-00-00)
Referenced Procedure - 71-13-00, P. Block 301	Cowl Doors

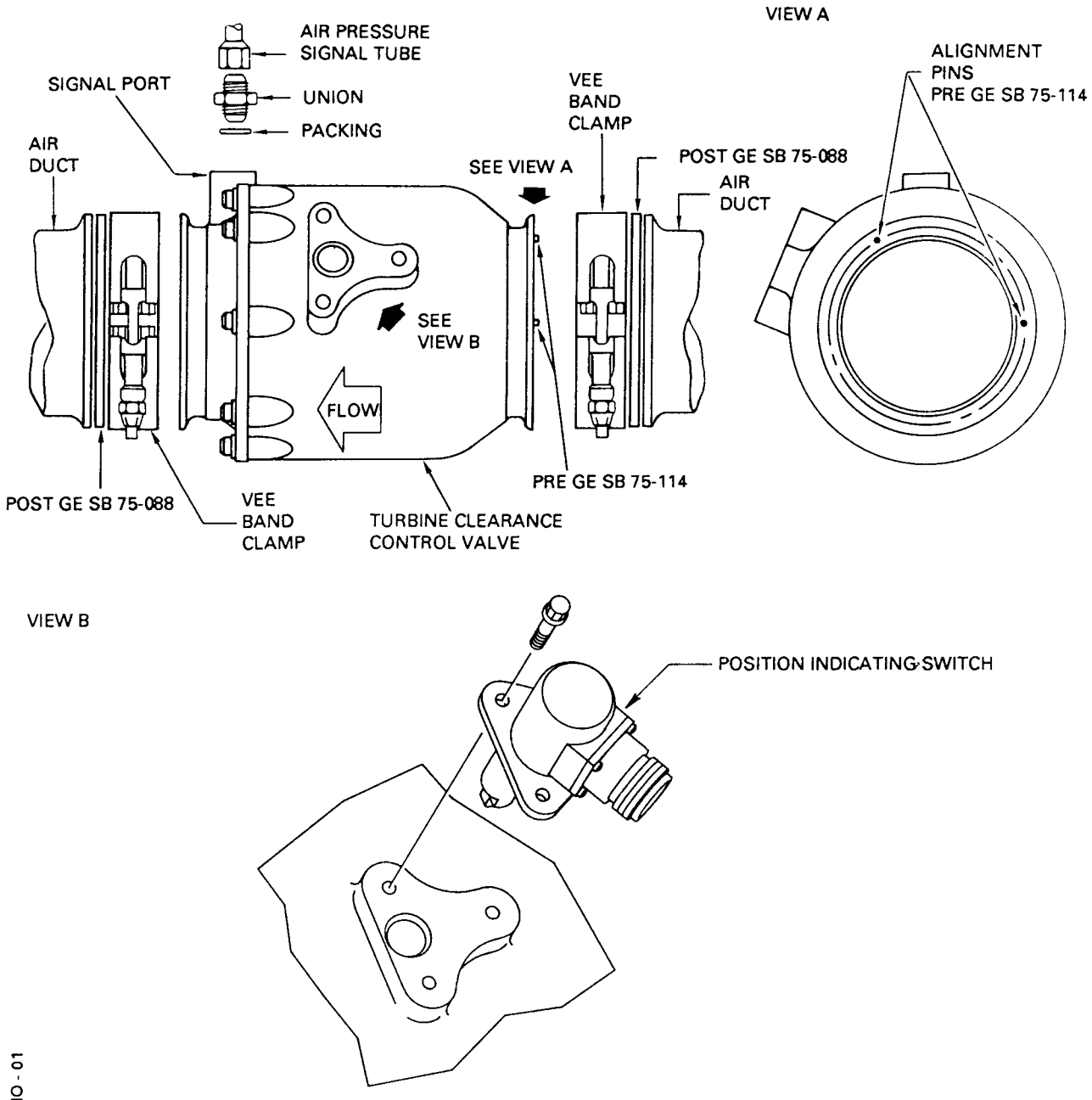
2. Procedure

A. Job Set-Up
(1)Open, safety and tag the appropriate circuits breakers and open cowl doors (Ref. 71-13-00, P. Block 301).

B. Removal (Ref. Fig. 401)
(1)Disconnect air pressure tube from signal port of valve.
(2)Disconnect position indicator switch on the body of valve.
(a)Remove 3 bolts securing switch to valve and remove switch. Retain switch for installation onto new valve.
(b)Install plate onto switch pad of valve and secure with 3 attachment bolts.
(3)Loosen and remove vee band clamps securing each end of valve to air duct. Separate the inlet end of the valve from the air manifold and remove valve.

Pre SB GE 75-114 AND 75-088
(4)Disengage the alignment pin.
NOTE : The flange at the inlet end of the valve has two alignment pins which mate with holes in the flange of the air manifold.
End Pre SB GE 75-114 AND 75-088
Post SB GE 75-114 AND 75-088
(5)Remove the E-seals from two sides of the valves.
End Post SB GE 75-114 AND 75-088
(6)Remove union and preformed packing from signal port of valve. Discard the preformed packing.
(7)Install protective covers on all openings in valve and air manifold.

C. Installation (Ref. Fig. 401)
(1)Apply lubricant (C02-033) to preformed packing and place preformed packing on union. Install union in signal port of valve and TORQUE to between 180 and 200 lbf.in. (2.03 and 2.26 m.daN).
(2)Place vee band clamps around air manifold, adjacent to the flanges.
Pre SB GE 75-114 AND 75-088
(3)Install replacement valve in the air manifold, positioned so that the pins in the valve flange align and engage with the holes in the air manifold flange. Arrow on valve should be pointing in direction of



Turbine Clearance Control Valve -
Removal/Installation
Figure 401

airflow, fan air to LPT cooling manifold. Secure with the vee band clamps. When clamps are snug, use a plastic mallet to tap around the clamp circumference to ensure proper seating. TORQUE to between 45 and 55 lbf.in. (0.51 and 0.62 m.daN).

End Pre SB GE 75-114 AND 75-088

Post SB GE 75-114 AND 75-088

(4)Install the E-seals on two sides of the valve.

End Post SB GE 75-114 AND 75-088

(5)Connect signal tube to fitting in valve and TORQUE to between 270 and 300 lbf.in. (3.1 and 3.4 m.daN).

(6)Remove three bolts attaching plate over position indicator switch pad.

(a)Position the indicator switch on valve and secure with 3 bolts.

(b)TORQUE bolts to between 24 and 27 lbf. in. (0.27 and 0.31 m.daN).

D. Close-Up

(1)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.

(2)Close cowl doors (Ref. 71-13-00, P. Block 301).
Remove safety clips and tags and close circuit breakers.

ACTIVE CLEARANCE CONTROL SIGNAL VALVE - REMOVAL/INSTALLATION

1. General

Maintenance of the ACC Signal Valve is limited to removal/installation and visual inspection. Access to the ACC Signal Valve is gained by opening the left thrust reverser cowl doors.

2. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breakers Safety Clips
B.	Torque Wrench 55 - 300 lbf.in. (0.62 - 3.4 m.daN)
C.	Corrosion Resistant Steel Lockwire
D. Material No.C02-019	Anti-Seize Compounds, Lubricants, Oils (Ref. 70-00-00)
Referenced Procedure - 71-13-00, P. Block 301	Cowl Doors

3. Procedure

A. Job Set-Up

(1)Open, safety and tag the appropriate engine circuit breakers and open thrust reverser cowl doors.

B. Removal (Ref. Fig. 401)

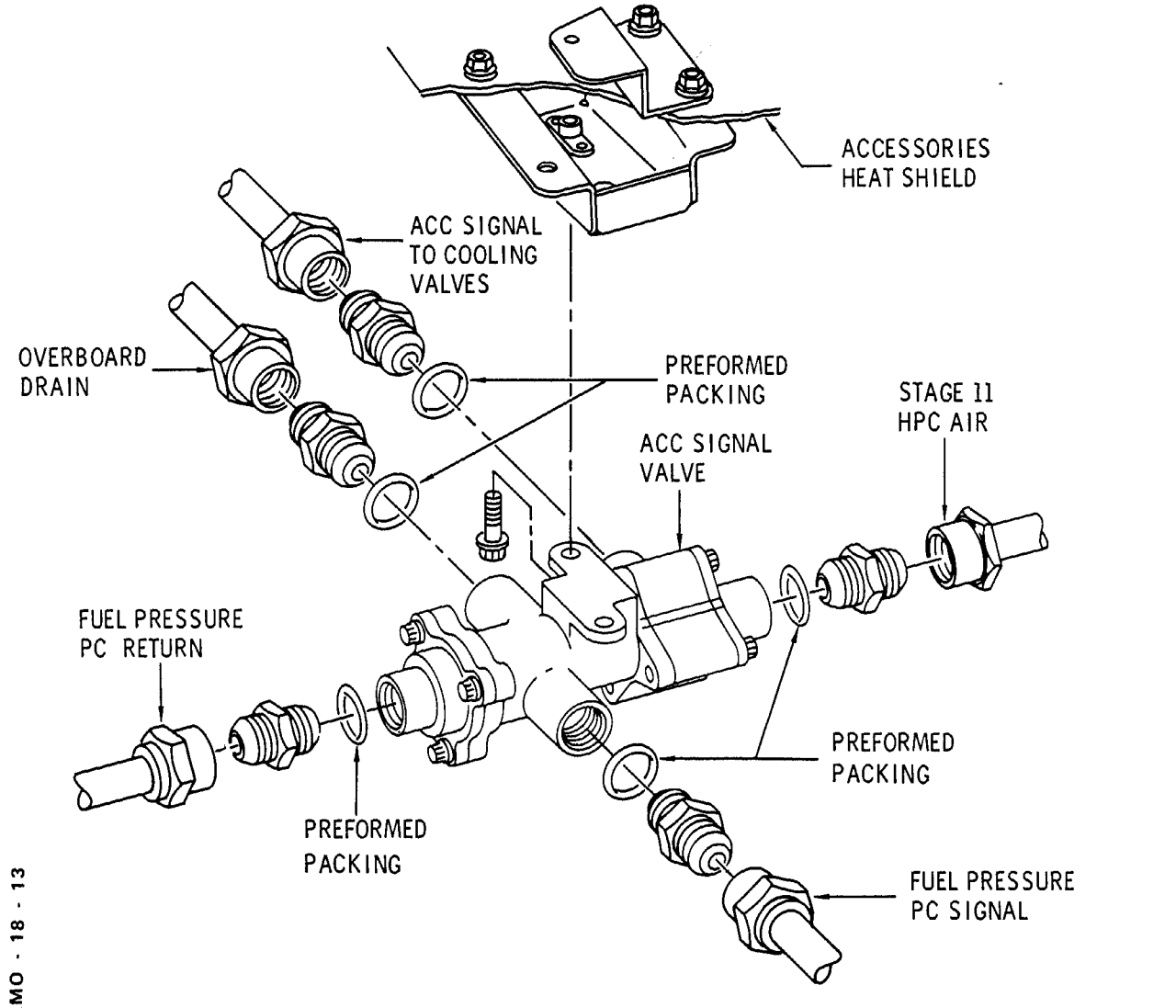
CAUTION : ALL TUBE OPENINGS AND PORTS MUST BE COVERED TO PREVENT ENTRY OF FOREIGN MATERIAL.

(1)Disconnect 11th stage air tube from ACC signal valve.
(2)Disconnect PCR tube from ACC signal valve after placing a suitable container under valve to catch any residual fuel.
(3)Disconnect fuel pressure (PC) signal tube from ACC signal valve.
(4)Disconnect overboard drain tube from ACC signal valve.
(5)Disconnect ACC signal tube from ACC signal valve.
(6)Remove two bolts securing valve to mounting bracket on the heat shield and remove valve.
(7)Remove all unions from ACC signal valve and retain for reuse if serviceable. Discard preformed packings.
(8)Cover tube openings and valve ports.

C. Installation (Ref. Fig. 401)

NOTE : Fuel components that have Fluorocarbon (Viton) external seals (SB 73-079) can leak for a short period of time when they are below -29°F (-34°C). If a leak occurs, continue the start to idle.
- If the fuel leakage stops in less than 5 minutes at idle, continue operation of the engine.
- If the fuel leakage continues after 5 minutes at idle, shut down the engine and repair the source of the leakage.

(1)Lightly coat preformed packings with engine oil (C02-019) and install onto unions.



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Active Clearance Control Signal Valve
Figure 401

(2)Install unions into ACC signal valve and TORQUE to between 180 and 200 lbf.in. (2.03 and 2.26 m.daN).
(3)Position sensor on mounting bracket and secure with two bolts. TORQUE bolts to between 55 and 70 lbf.in. (0.62 and 0.79 m.daN).
(4)Connect ACC signal tube to ACC signal valve and TORQUE B nut to between 270 and 300 lbf.in. (3.05 and 3.39 m.daN) and wirelock.
(5)Connect overboard drain tube to ACC signal valve and TORQUE B nut to between 270 and 300 lbf.in. (3.05 and 3.4 m.daN).
(6)Connect fuel pressure PC signal tube to ACC signal valve and TORQUE B nut to between 270 and 300 lbf.in. (3.05 and 3.4 m.daN)
(7)Connect fuel pressure PC return tube to ACC signal valve and TORQUE B nut to between 270 and 300 lbf.in. (3.05 and 3.4 m.daN).
(8)Connect 11th stage air tube to ACC signal valve and TORQUE B nut to between 270 and 300 lbf.in. (3.05 and 3.4 m.daN) and wirelock.
NOTE : The fuel tubes to the ACC signal valve do not receive pressure until approximately 20,000 feet of altitude. Ensure the seating surfaces mate properly and the torque values are met.

D. Close-Up
(1)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.
(2)Close thrust reverser cowl doors (Ref. 71-13-00, P. Block 301). Remove safety clips and tags and close circuit breakers.

CORE COMPARTMENT COOLING AIR VALVE - REMOVAL/INSTALLATION

1. Equipment and Materials

ITEM	DESIGNATION
A.	Access Platform
B.	Circuit Breaker Safety Clips
C. Material No.C02-021	Anti-Seize Compounds, Lubricants, Oils (Ref. 70-00-00)
D.	Torque Wrench 55-200 lbf.in. (0.62 - 2.26 m.daN)
Referenced Procedure - 71-13-00, P. Block 301	Cowl Doors

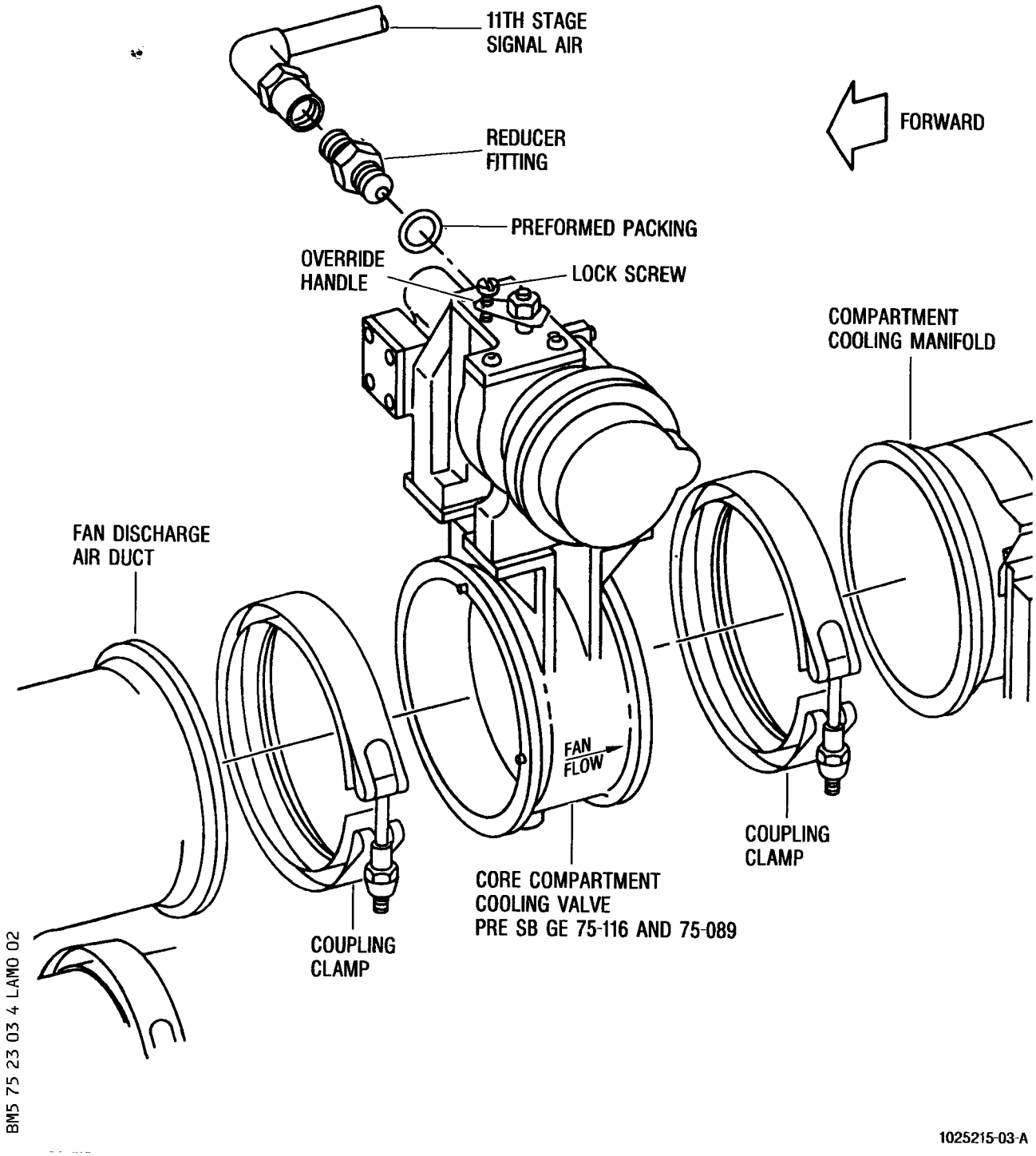
2. Procedure

A. Job Set-Up
(1)Open, safety and tag the appropriate circuit breakers and open fan and thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).
(2)Install access platform.

B. Removal (Ref. Fig. 401)
(1)Disconnect 11th stage air signal line from valve.
(2)Lock valve butterfly in closed position to protect sealing edge as follows :
(a)Remove set screw and lock screw from storage holes.
(b)Rotate override handle to closed position and secure by inserting lock screw down through hole in override handle and into set screw storage hole in shaft retaining plate. Hand tighten lock screw.
(3)Remove the two coupling clamps securing the valve to the fan discharge air duct and the compartment cooling manifold. Remove valve.
(4)Remove reducer fitting from 11th stage air port on valve and retain for reuse if serviceable. Discard preformed packing from reducer fitting.

C. Installation (Ref. Fig. 401)
(1)Lubricate new preformed packing with oil (C02-021) and install on 11th stage union. Install reducer fitting into valve and TORQUE to between 155 and 175 lbf.in. (1.75 and 1.98 m.daN).
(2)Lock valve butterfly in closed position to protect sealing edge as follows :
(a)Remove set screw and lock screw from storage holes.
(b)Rotate override handle to closed position and secure by inserting lock screw down through hole in override handle and into set screw storage hole in shaft retaining plate. Hand tighten lock screw.

Pre SB GE 75-116 AND 75-089
(3)Position valve between fan discharge duct and compartment cooling manifold ensuring alignment pins on valve mate properly with fan duct.
End Pre SB GE 75-116 AND 75-089
Post SB GE 75-116 AND 75-089



Core Compartment Cooling Valve - Removal/Installation
Figure 401

(3)Position valve between fan discharge duct and compartment cooling manifold.

End Post SB GE 75-116 AND 75-089

(4)Secure valve in place with coupling clamps. Tighten coupling clamp to a final TORQUE of 50 lbf.in. (0.56 m.daN).

(5)Connect 11th stage air signal line to valve and TORQUE B-nut on line to between 270 and 300 lbf.in. (3.05 and 3.39 m.daN).

(6)Return valve butterfly to open position as follows :

(a)Remove lock screw from override handle and allow to return to open position.

(b)Install lock screw and set screw in storage holes and hand tighten.

D. Close-Up

(1)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.

(2)Remove access platform.

(3)Close thrust reverser and fan cowl doors (Ref. 71-13-00, P. Block 301). Remove safety clips and tags and close circuit breakers.

Pre SB GE 75-148

LPT COOLING AIR MANIFOLD - REMOVAL/INSTALLATION

1. General

A. This procedure will provide the instructions necessary for the removal and installation of the twelve segments making up the LPT cooling air manifold (birdcage).

2. Equipment and Materials

ITEM	DESIGNATION
A.	Piston Ring
B. Material No.C02-002	Anti-Seize Compounds, Lubricants, Oils (Ref. 70-00-00)
C. Material No.C02-033	Anti-Seize Compounds, Lubricants, Oils (Ref. 70-00-00)
Referenced Procedures	
- 70-00-00, P. Block 201	Standard Practices - Engine - General
- 71-13-00, P. Block 301	Cowl Doors

NOTE : If all twelve segments are not being removed and/or replaced, consult applicable IPC for specific expendable parts required.

3. Procedure

A. Job Set-Up
(1)Open the fan cowl, fan reverser cowl, and core cowl doors. (Ref. 71-13-00, P. Block 301).
(2)Open, safety and tag the appropriate circuit breakers.

Pre SB GE 75-122

B. Removal (Ref. Fig. 401, 403)
(1)Loosen, disconnect, or remove any QEC equipment necessary to gain access to the LPT cooling air manifold.
(2)Removal of the LPT Cooling Air Manifold Segments.
NOTE : Segments may be removed and/or replaced individually as required. This procedure is written assuming all segments are being removed.
(a)Disconnect the T5 electrical leads from the T5 sensor (Ref. Fig. 401) (Sheet 1).
(b)Working from the sensor forward, remove the nuts, washers, and bolts (4 places) securing the T5 sensor electrical lead to LPT case bracket (1 place) and LPT manifold (3 places). Carefully move the T5 sensor electrical lead aside to gain access to the LPT cooling air manifold.

Pre SB GE 75-098

(c)Remove insulation blankets and tiedown straps from LPT cooling air manifold segments.

End Pre SB GE 75-098

CAUTION : DO NOT REMOVE THE RETAINING NUTS THAT ATTACH THE FORWARD AND AFT MANIFOLD BRACKETS TO THE LOW PRESSURE TURBINE CASE.

REMOVING THESE NUTS CAN RESULT IN THE BOLTS FALLING INTO THE ENGINE CASE, FORCING A PREMATURE ENGINE REMOVAL.

(d) If necessary, remove bolts and nuts from the aft end of the support links attached to the LPT forward brackets.

(e) If necessary, remove the D-sump oil supply, D-sump oil scavenge, and combustor drain lines as follows (Ref. Fig. 403) :

1 Remove the spray shields and loosen the B-nuts at each end of the lines as necessary.

2 Remove any necessary bolts, nuts, and clamps that attach the lines to the turbine rear frame.

3 Remove any necessary bolts, nuts, and clamps that attach the lines to the LPT cooling air manifold.

4 Remove the D-sump oil supply, D-sump oil scavenge, and combustor drain lines as necessary.

(f) Beginning at the 10 o'clock position (aft looking forward) and working counterclockwise, remove the 2 nuts, bolts, and manifold clips securing the aft end of the manifold segment (No. 11) to the LPT stator case bracket (Ref. Fig. 401, 403).

CAUTION : DO NOT REMOVE THE NUTS HOLDING THE LPT COOLING MANIFOLD BRACKET TO THE LPT CASE. THE RETAINER BOLT WILL FALL INTO THE LPT CASE CAVITY.

(g) Remove the nut, bushing, and bolt securing the forward end of the manifold segment (No. 11) to the LPT stator case bracket.

(h) Loosen the aft manifold clips of the adjacent LPT manifold segments (9 and 11 o'clock positions) so that the clips are free of the LPT stator case brackets.

(i) Remove the nuts, bushings, and bolts securing the forward end of the adjacent LPT manifold segments to the stator case brackets.

(j) Remove the No. 11 manifold segment by carefully pulling outward, disconnecting the cooling air feeder tubes from the adjacent manifold segments, then sliding aft until clear of the 7th stage cooling air manifold.

(k) Remove the No. 10 manifold segment by pulling the segment outward and clockwise to disconnect the cooling air feeder tubes from segment No. 9 and then sliding aft until clear of the 7th stage cooling air manifold.

(l) Remove the 12 bolts securing the 3 LP recoup tubes to the exhaust cone.

(m) Loosen the 12 bolts and nuts securing the 3 LP recoup tubes to the pads of the compressor rear frame.

(n) To increase clearance, loosen the hardware attaching the 3 LP recoup tubes to compressor rear frame and turbine rear frame brackets.

(o) Remove the LPT inlet manifolds from air manifolds at 9 and 3 o'clock positions as follows :

1 Loosen the V-band clamp connecting the air manifold with the LPT inlet manifold and disengage from the tube joint.

2 Loosen the nuts, bolts, and manifold clips securing the manifold segment to LPT stator case aft bracket. Loosen this same hardware on the adjacent manifold segment.

3 Remove the nut, bushing, and bolt securing the adjacent manifold segment to the forward stator case bracket.

4 Carefully pull the manifold segment outward disengaging the cooling feeder tubes from the adjacent manifold segment. Move aft until clear

of the 7th stage cooling air manifold.

(p)Continue working in a counterclockwise direction removing the remaining LPT manifold segments.

NOTE : Removal of the LPT manifold segments beneath the oil supply and oil scavenge tubes should be accomplished without disturbing the oil tube coupling nuts to avoid pressure test of tubes.

(q)Remove piston rings from all LPT manifold segment tubes.
Discard piston rings.

End Pre SB GE 75-122
Post SB GE 75-122

B. Removal (Ref. Fig. 402, 403)

(1)Loosen, disconnect, or remove any QEC equipment necessary to gain access to the LPT cooling air manifold.

(2)Removal of the LPT Cooling Air Manifold Segments.

NOTE : Segments may be removed and/or replaced individually as required. This procedure is written assuming all segments are being removed.

(a)Disconnect the T5 electrical leads from the T5 sensor (Ref. Fig. 402) (Sheet 1).

(b)Working from the sensor forward, remove the nuts, washers, and bolts (4 places) securing the T5 sensor electrical lead to LPT case bracket (1 place) and LPT manifold (3 places). Carefully move the T5 sensor electrical lead aside to gain access to the LPT cooling air manifold.

CAUTION : DO NOT REMOVE THE RETAINING NUTS THAT ATTACH THE FORWARD AND AFT MANIFOLD BRACKETS TO THE LOW PRESSURE TURBINE CASE. REMOVING THESE NUTS CAN RESULT IN THE BOLTS FALLING INTO THE ENGINE CASE, FORCING A PREMATURE ENGINE REMOVAL.

(c)If necessary, remove bolts and nuts from the aft end of the support links attached to the LPT forward brackets.

(d)If necessary, remove the D-sump oil supply, D-sump oil scavenge, and combustor drain lines as follows (Ref. Fig. 403) :

1 Remove the spray shields and loosen the B-nuts at each end of the lines, as necessary.

2 Remove any necessary bolts, nuts, and clamps that attach the lines to the turbine rear frame.

3 Remove any necessary bolts, nuts, and clamps that attach the lines to the LPT cooling air manifold.

4 Remove the D-sump oil supply, D-sump oil scavenge, and combustor drain lines as necessary.

(e)Beginning at the 10 o'clock position (aft looking forward) and working counterclockwise, remove the 2 nuts, bolts, and manifold clips securing the aft end of the manifold segment (No. 11) to the LPT stator case bracket (Ref. Fig. 402, 403).

CAUTION : DO NOT REMOVE THE NUTS HOLDING THE LPT COOLING MANIFOLD BRACKET TO THE LPT CASE. THE RETAINER BOLT WILL FALL INTO THE LPT CASE CAVITY.

(f)Loosen the aft manifold clips of the adjacent LPT manifold segments (9 and 11 o'clock positions) so that the clips are free of the LPT stator case brackets.

(g)Loosen all V-band clamps (Ref. Fig. 402) (sheet 3).

(h)Remove the No. 11 manifold segment by carefully pulling outward,

disconnecting the large cooling air feeder tube from the adjacent manifold segments, then sliding aft until clear of the 7th stage cooling air manifold.

(i)Remove the No. 10 manifold segment by pulling the segment outward and clockwise to disconnect the large cooling air feeder tube from segment No. 9 and then sliding aft until clear of the 7th stage cooling air manifold.

(j)Remove the 12 bolts securing the 3 LP recoup tubes to the exhaust cone.

(k)Loosen the 12 bolts and nuts securing the 3 LP recoup tubes to the pads of the compressor rear frame.

(l)To increase clearance, loosen the hardware attaching the 3 LP recoup tubes to compressor rear frame and turbine rear frame brackets.

(m)Remove the LPT inlet manifolds from air manifolds at 9 and 3 o'clock positions as follows :

1 Loosen the V-band clamp connecting the air manifold with the LPT inlet manifold and disengage from the tube joint.

2 Loosen the nuts, bolts, and manifold clips securing the manifold segment to LPT stator case aft bracket. Loosen this same hardware on the adjacent manifold segment.

3 Carefully pull the manifold segment outward disengaging the large cooling feeder tube from the adjacent manifold segment. Move aft until clear of the 7th stage cooling air manifold.

(n)Continue working in a counterclockwise direction removing the remaining LPT manifold segments.

NOTE : Removal of the LPT manifold segments beneath the oil supply and oil scavenge tubes should be accomplished without disturbing the oil tube coupling nuts to avoid pressure test of tubes.

End Post SB GE 75-122

Pre SB GE 75-122

C. Installation (Ref. Fig. 401, 403)

(1)Installation of the LPT Manifold Segments.

(a)Position and align one of the LPT inlet manifold segments with air manifold.

1 Loosely install the V-band clamp around the tube joint.

2 Align the manifold segment aft end with LPT stator case brackets and install manifold clips, bolts, and nuts into the aft stator case bracket. Do not torque at this time.

(b)Lubricate the 9 or 10 assorted piston rings with white fonoline (C02-033).

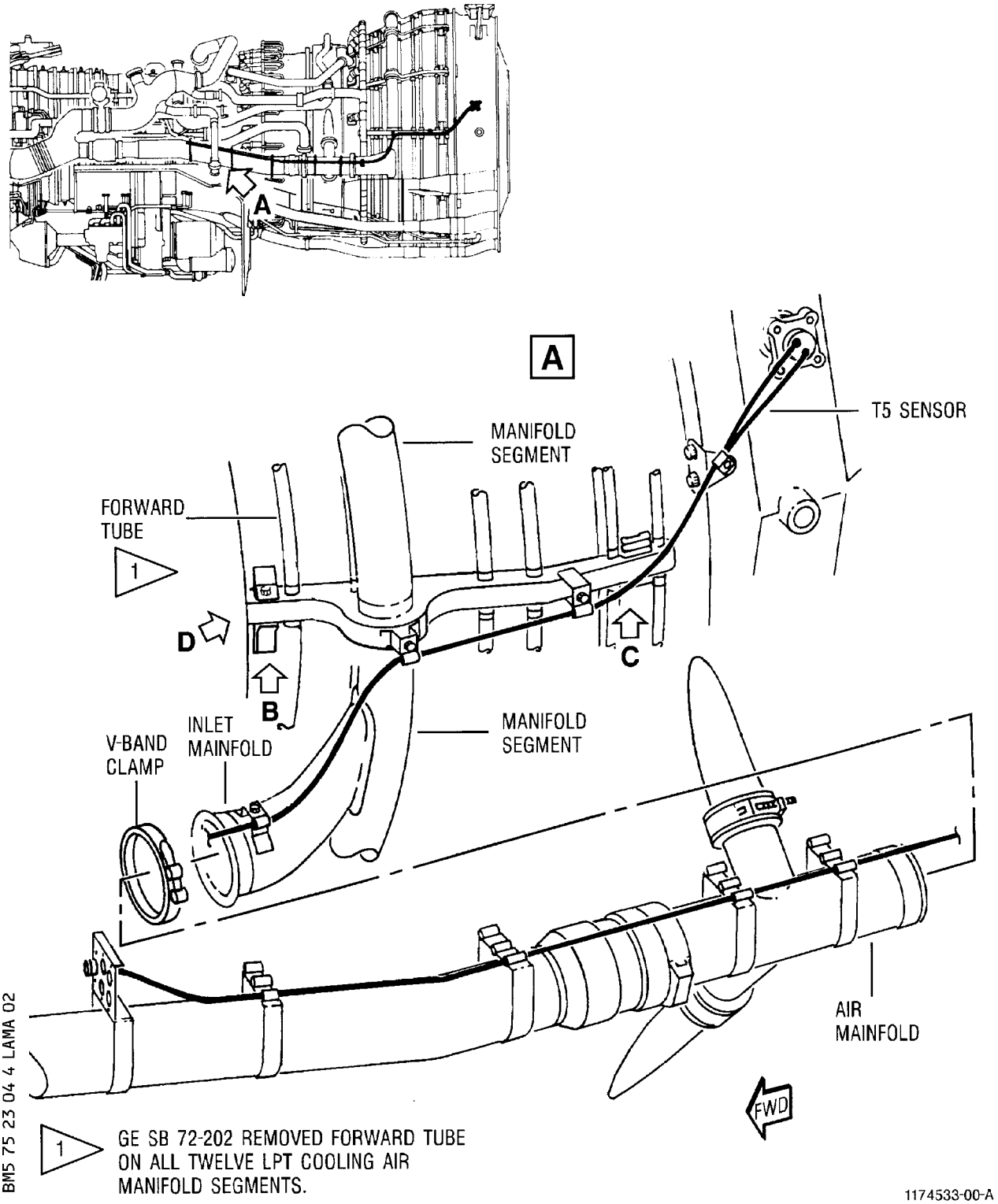
(c)Install the appropriate piston ring on to the individual feeder tubes and main tube of the segment.

(d)Position the next LPT manifold segment aligning and engaging the individual feeder tubes and stator case brackets.

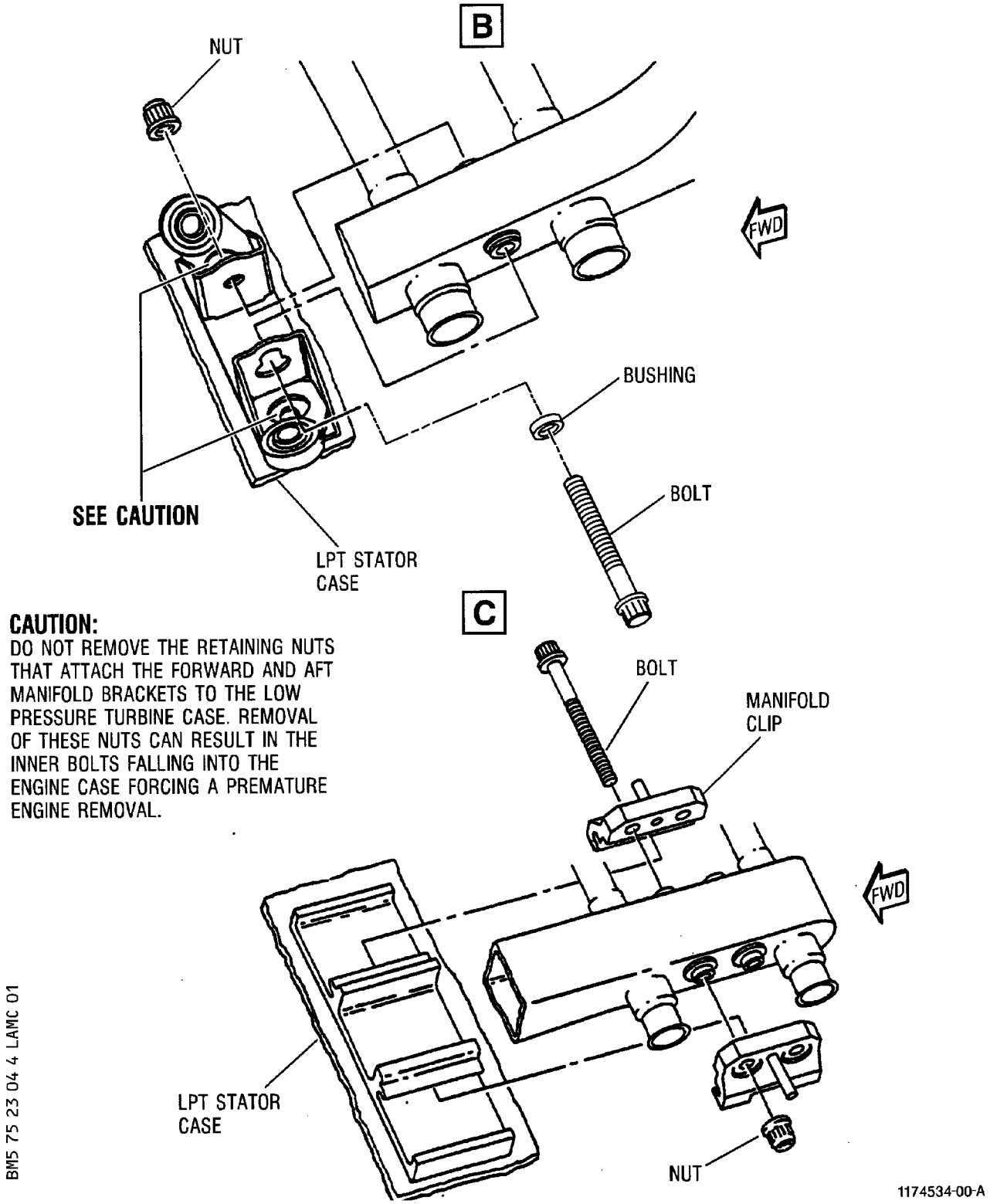
(e)Install the bolt, bushing (against nut), and nut at the forward stator case bracket where the 2 manifolds are connected. Do not torque at this time.

(f)Install the manifold clips, bolts, and nuts securing the manifold segments to the aft stator case brackets. Do not torque at this time.

(g)Continue to install piston rings, manifold segments, and attaching hardware until all manifold segments are installed and secured at each



LPT Cooling Air Manifold - Removal/Installation
(Pre SB GE 75-122) (Sheet 1/3)
Figure 401



CAUTION:
DO NOT REMOVE THE RETAINING NUTS THAT ATTACH THE FORWARD AND AFT MANIFOLD BRACKETS TO THE LOW PRESSURE TURBINE CASE. REMOVAL OF THESE NUTS CAN RESULT IN THE INNER BOLTS FALLING INTO THE ENGINE CASE FORCING A PREMATURE ENGINE REMOVAL.

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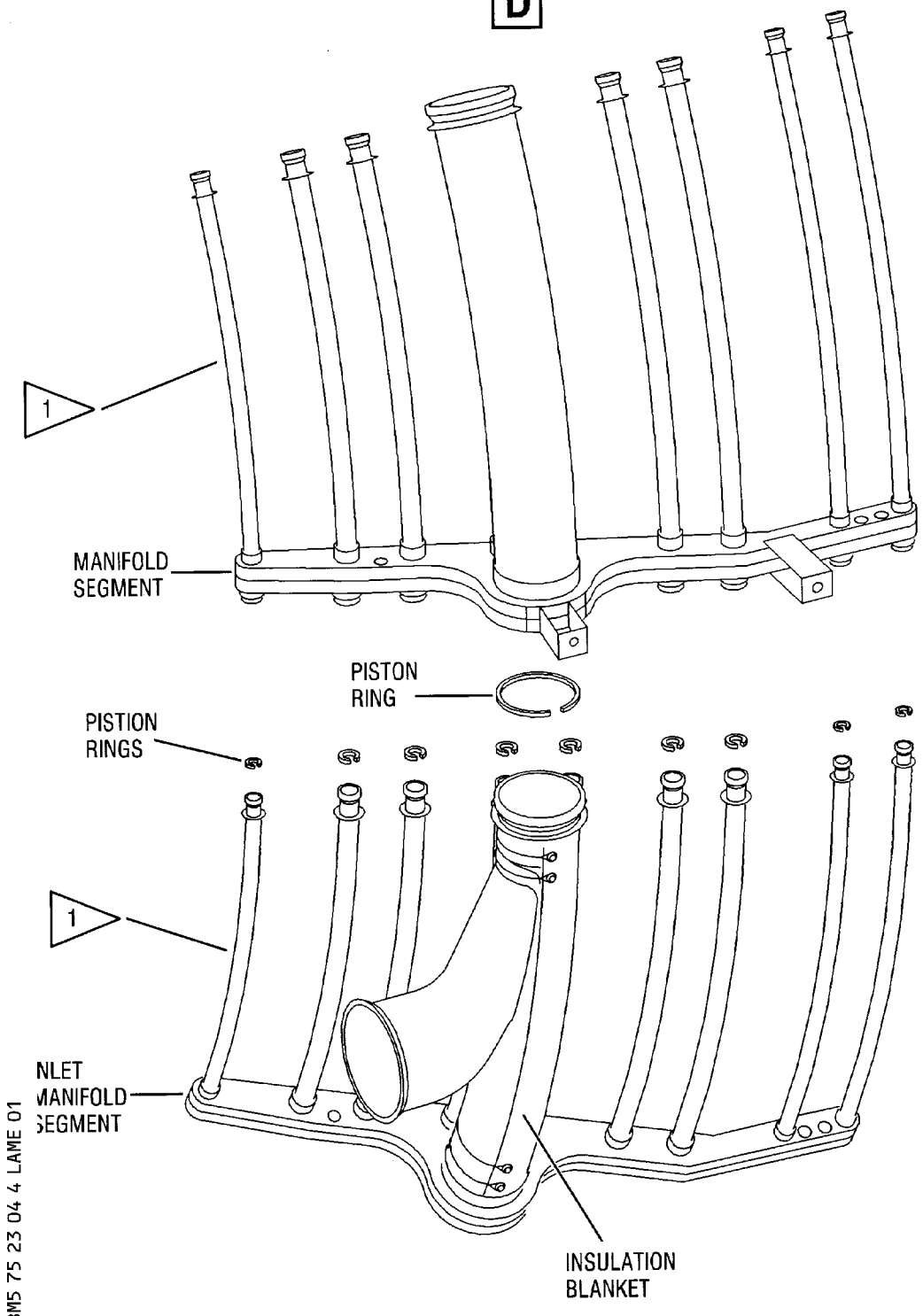
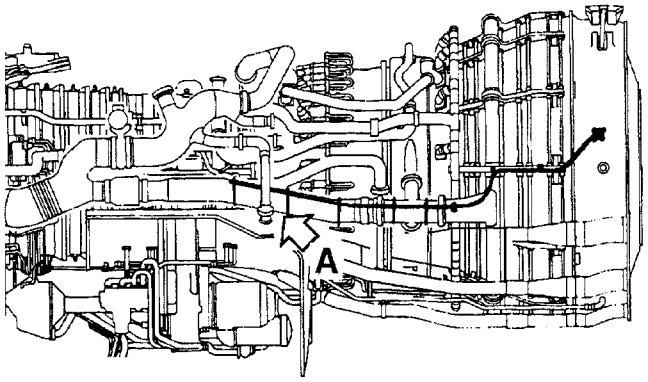
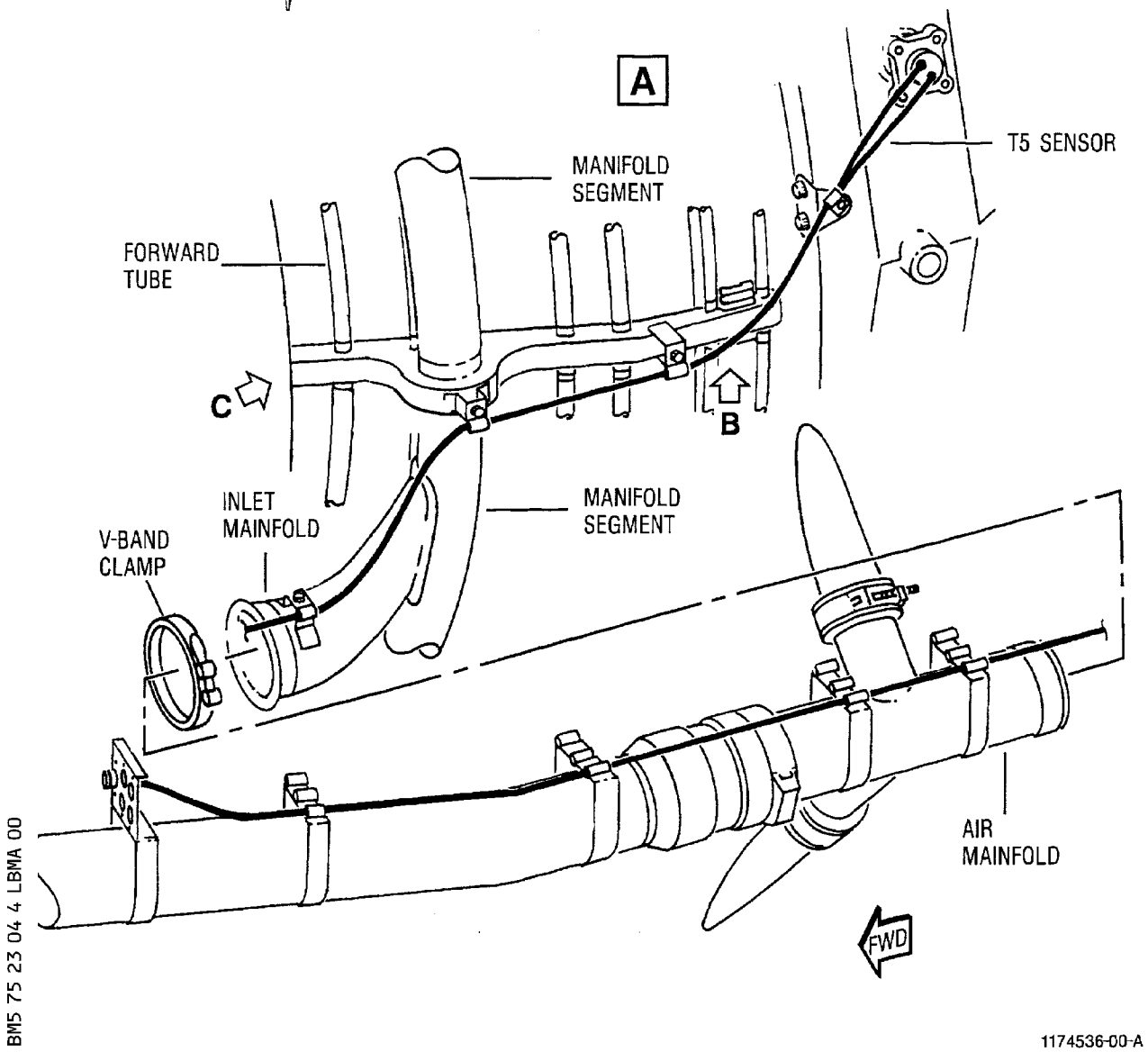
LPT Cooling Air Manifold - Removal/Installation
(Pre SB GE 75-122) (Sheet 2/3)
Figure 401

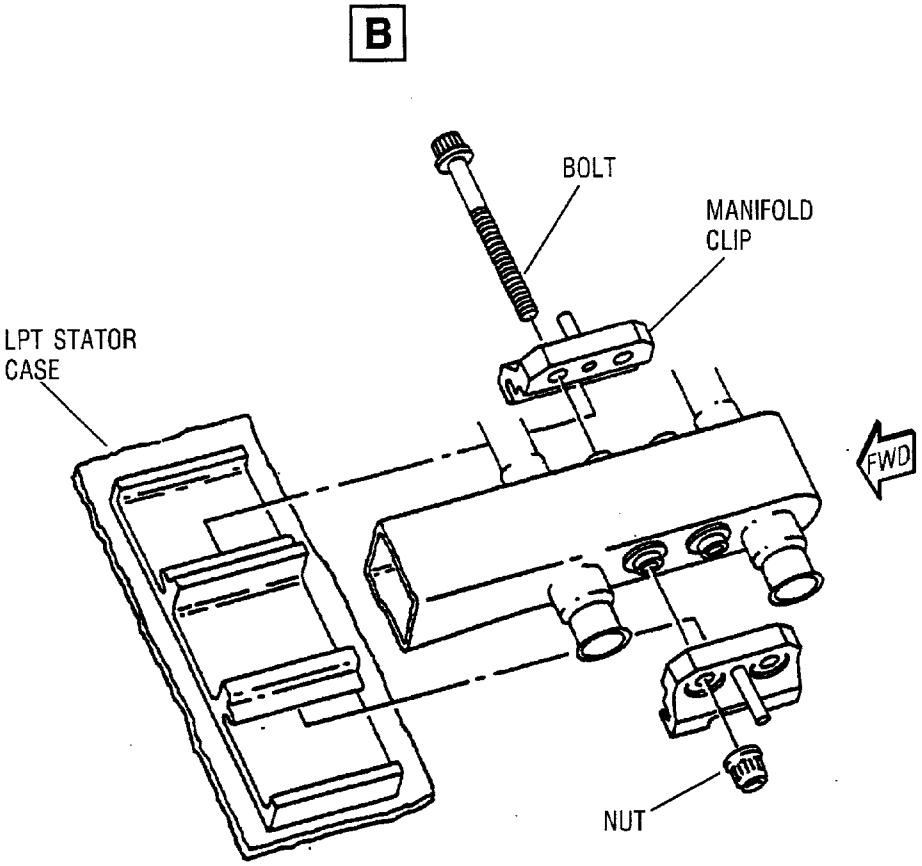


LPT Cooling Air Manifold - Removal/Installation
(Pre SB GE 75-122) (Sheet 3/3)
Figure 401





LPT Cooling Air Manifold - Removal/Installation
(Post SB GE 75-122) (Sheet 1/3)
Figure 402



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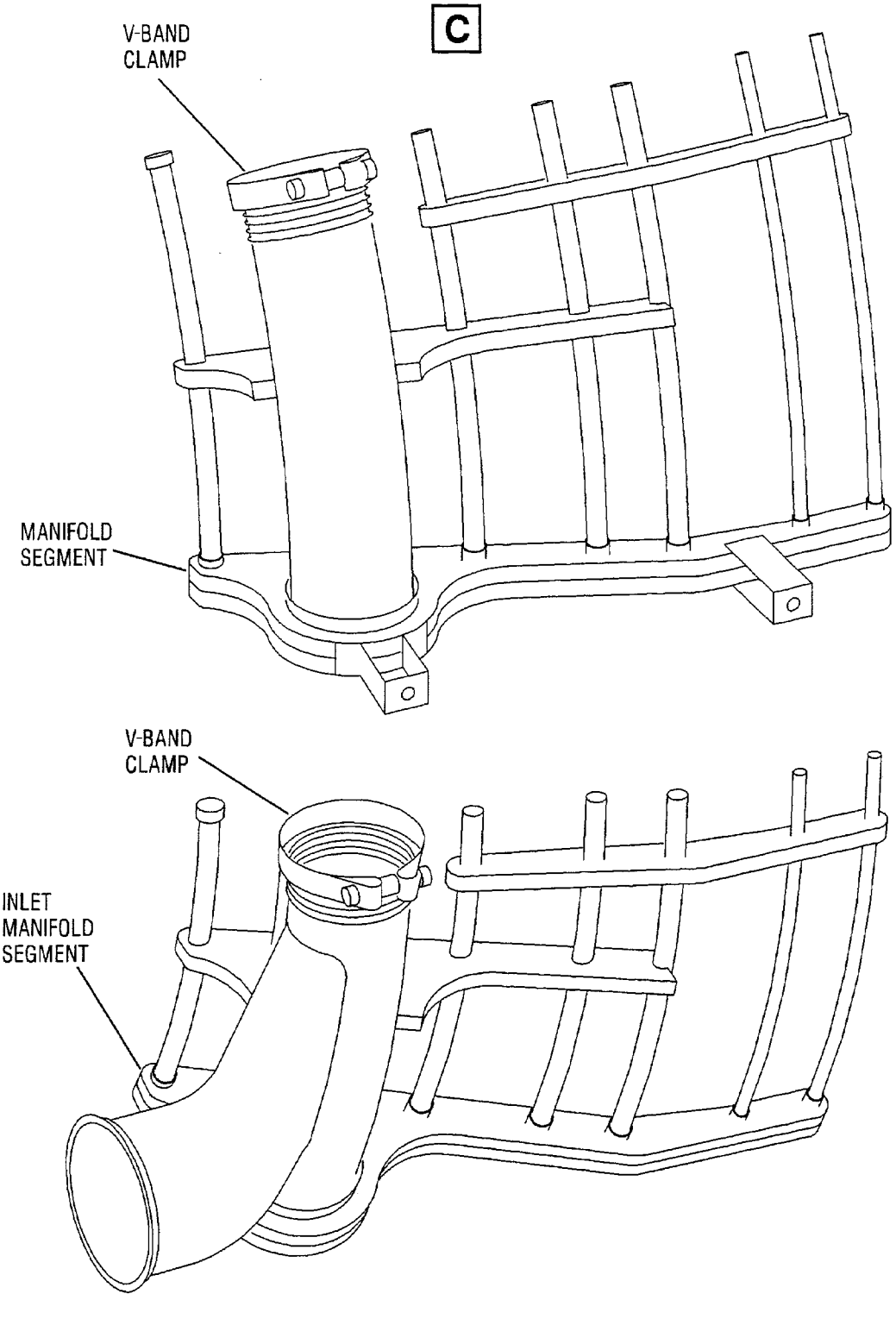
LPT Cooling Air Manifold - Removal/Installation
(Post SB GE 75-122) (Sheet 2/3)
Figure 402



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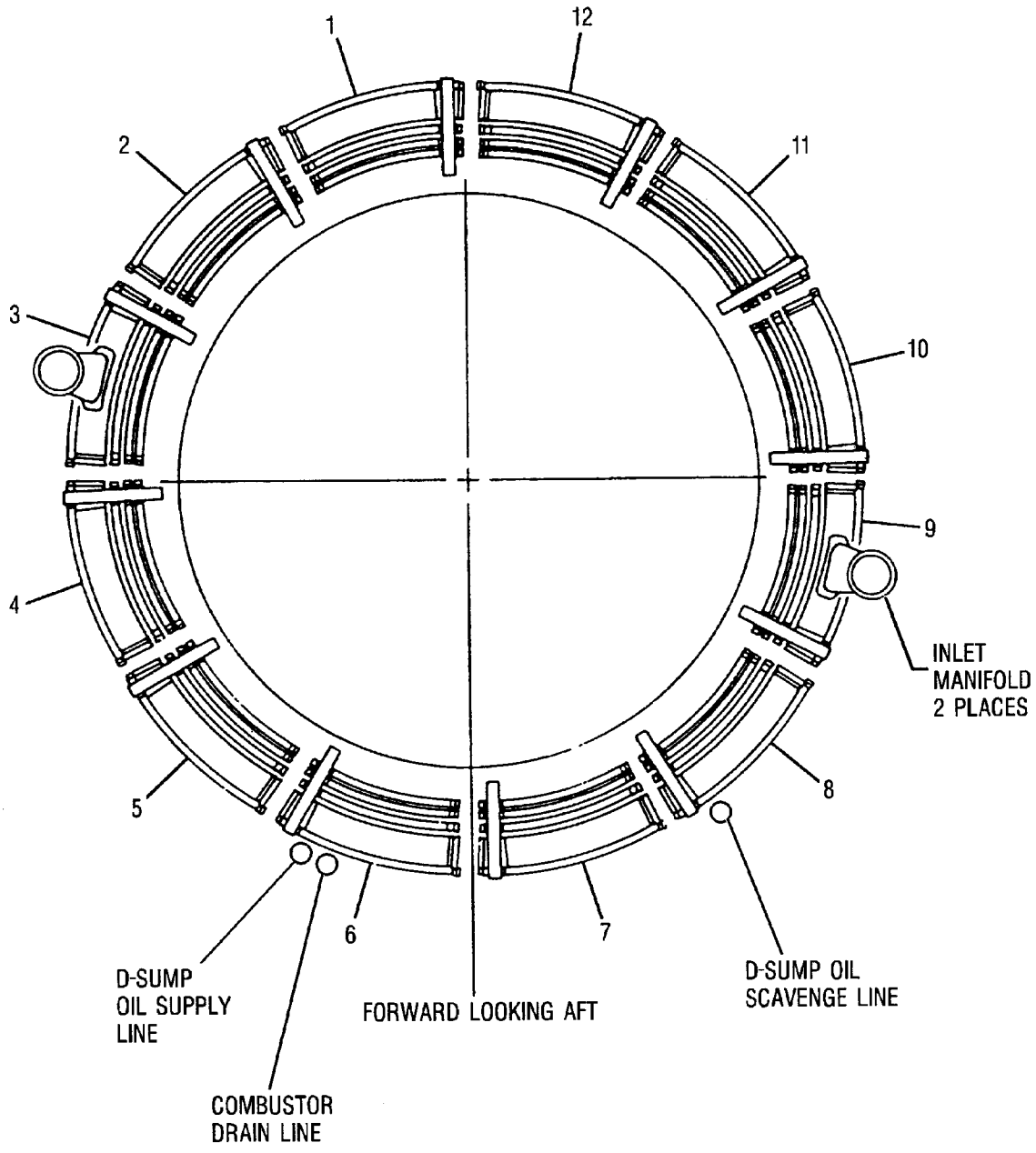
LPT Cooling Air Manifold - Removal/Installation
(Post SB GE 75-122) (Sheet 3/3)
Figure 402



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LPT Cooling Air Manifold - Segment Position
Figure 403

stator case bracket and tube junction.

(h)TORQUE the V-band clamps at each inlet manifold/air manifold junction to 50 lbf.in. (0.56 m.daN) (Ref. 70-00-00, P. Block 201) as follows :

1 Install the two V-band clamps (Ref. Fig. 401) (Detail A) and TORQUE the nuts to 25 lbf.in. (0.28 m.daN).

2 With a plastic or other non-metallic mallet tap around the circumference of the coupling to make the V-band clamp tension even.

3 Increase the torque and at the same time continue tapping around the circumference.

4 When the torque is 50 lbf.in. (0.56 m.daN) tap around the V-band circumference one time more.

5 TORQUE the V-band clamp to 50 lbf.in. (0.56 m.daN).

(i)TORQUE the 12 nuts on the forward stator case to segment brackets to 65 lbf.in. (0.73 m.daN). TORQUE the 24 aft bracket bolts and nuts to 25 lbf.in. (0.28 m.daN).

(2)If removed, install links to the LPT forward brackets as follows :

WARNING : THREAD COMPOUND LUBRICATING GREASE IS AN AGENT THAT IS AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN THREAD COMPOUND LUBRICATING GREASE IS USED. DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES. USE IN AN AREA OPEN TO THE AIR. CLOSE THE CONTAINER WHEN NOT USED.

(a)Coat all bolts with Material No.C02-058.

(b)Install links to LPT forward brackets using bolts and nuts.

(c)TORQUE nuts to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN).

(3)If removed, install aft end of the D-sump oil scavenge line to the turbine rear frame fitting at the 5 o'clock position. Install the forward end to the D-sump oil scavenge line (Ref. Fig. 403).

(a)Tighten the coupling nuts finger tight.

(b)Install any removed clamps, bolts, and nuts. Tighten nuts finger tight.

(c)TORQUE D-sump lube scavenge line aft B-nut coupling at turbine rear frame strut fitting and forward B-nut coupling to between 650 and 770 lbf.in. (7.34 and 8.70 m.daN).

(d)TORQUE loop clamp nuts to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN).

(4)If removed, install the aft end of the D-sump oil supply line to the turbine rear frame fitting at the 5 o'clock position. Install the forward end to the D-sump oil supply line (Ref. Fig. 403).

(a)Tighten the coupling nuts finger tight.

(b)Install any removed loop clamps, bolts, and nuts.

(c)Tighten nuts finger tight.

(d)TORQUE the D-sump oil supply line aft B-nut at the turbine rear frame strut connection and the forward B-nut to between 450 and 550 lbf.in. (5.08 and 6.21 m.daN).

(e)TORQUE loop clamp nuts to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN).

(f)Install spray shields.

(5)If removed, install the combustor drain line at the 7 o'clock position (Ref. Fig. 403).

(a)Install any removed loop clamps, bolts, and nuts.

(b)TORQUE loop clamp nuts to between 33 and 37 lbf.in. (0.37 and

0.42 m.daN).
(c)TORQUE forward and aft combustor drain line B-nuts to between 180 and 200 lbf.in. (2.03 and 2.26 m.daN).
(6)Attach the LP recoup tubes as follows :
WARNING : THREAD COMPOUND LUBRICATING GREASE IS AN AGENT THAT IS AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN THREAD COMPOUND LUBRICATING GREASE IS USED. DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES. USE IN AN AREA OPEN TO THE AIR. CLOSE THE CONTAINER WHEN NOT USED.
(a)Attach the 3 LP recoup tubes to the exhaust cone using 12 bolts coated with Material No.C02-002. TORQUE the bolts to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN).
(b)TORQUE the 12 bolts and nuts securing the 3 LP recoup tubes to the compressor rear frame pads to between 55 and 70 lbf.in. (0.62 and 0.79 m.daN).
(c)TORQUE the 6 bolts and nuts securing the 3 LP recoup tubes to compressor rear frame brackets, to between 55 and 70 lbf.in. (0.62 and 0.79 m.daN).
(d)TORQUE the 6 bolts and nuts securing the 3 LP recoup tubes to the turbine rear frame brackets, to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN).
(7)Reconnect the leads to the T5 sensor as follows :
(a)Secure the lead clamps to the LPT manifold (3 places) and stator case bracket (1 place) using bolts, washers, and nuts.
R (b)TORQUE the smaller lead nut to between 12 and 14 lbf.in. (0.13 and
R 0.16 m.daN).
R (c)TORQUE the larger lead nut to between 20 and 30 lbf.in. (0.22 and
R 0.34 m.daN).
(d)TORQUE the lead clamp nuts to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN).
Pre SB GE 75-098
(8)Install insulation brackets and tie down straps on LPT cooling air manifold segments.
End Pre SB GE 75-098
(9)Install, connect, or tighten any QEC equipment loosened, disconnected, or removed in step 3. B. (1).
End Post SB GE 75-122
Post SB GE 75-122

C. Installation (Ref. Fig. 402, 403)
(1)Installation of the LPT Manifold Segments.
(a)Position and align one of the LPT inlet manifold segments with air manifold.
1 Loosely install the V-band clamp around the tube joint.
2 Align the manifold segment aft end with LPT stator case brackets and install manifold clips, bolts, and nuts into the aft stator case bracket. Do not torque at this time (Ref. Fig. 402) (Detail B).
(b)Position the next LPT manifold segment aligning and engaging the large feeder tube and stator case brackets.
(c)Install the manifold clips, bolts, and nuts that attach the manifold

segments to the aft stator case brackets (Ref. Fig. 402) (Detail B). Do not torque at this time.

(d) Continue to install manifold segments and attaching hardware until all manifold segments are installed and secured at each stator case bracket and tube junction.

(e) TORQUE all V-band clamps that connect the LPT cooling air manifold segments to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN) (Ref. Fig. 402) (Detail C).

(f) TORQUE the 24 bolts and nuts securing the aft LPT stator case manifold clips to 25 lbf.in. (0.28 m.daN).

(g) TORQUE the V-band clamps at each inlet manifold/air manifold junction to 50 lbf.in. (0.56 m.daN) (Ref. 70-00-00, P. Block 201) as follows :

1 Install the two V-band clamps (Ref. Fig. 402) (Detail A) and TORQUE the nuts to 25 lbf.in. (0.28 m.daN).

2 With a plastic or other non-metallic mallet tap around the circumference of the coupling to make the V-band clamp tension even.

3 Increase the torque and at the same time continue tapping around the circumference.

4 When the torque is 50 lbf.in. (0.56 m.daN) tap around the V-band circumference once more.

5 TORQUE the V-band clamp to 50 lbf.in. (0.56 m.daN).

(2) If removed, install links to the LPT forward brackets as follows :

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(a) Coat all bolts with Material No.C02-058.

(b) Install links to LPT forward brackets using bolts and nuts.

(c) TORQUE nuts to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN).

(3) If removed, install aft end of the D-sump oil scavenge line to the turbine rear frame fitting at the 5 o'clock position. Install the forward end to the D-sump scavenge oil line. (Ref. Fig. 403).

(a) Tighten the coupling nuts finger tight.

(b) Install any removed clamps, bolts, and nuts. Tighten nuts finger tight.

(c) TORQUE D-sump lube scavenge line aft B-nut coupling at turbine rear frame strut fitting and forward B-nut coupling to between 650 and 770 lbf.in. (7.34 and 8.70 m.daN).

(d) TORQUE loop clamp nuts to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN).

(4) If removed, install the aft end of the D-sump oil supply line to the turbine rear frame fitting at the 7 o'clock position. Install the forward end to the D-sump oil supply line (Ref. Fig. 403).

(a) Tighten the coupling nuts finger tight.

(b) Install any removed loop clamps, bolts, and nuts.

(c) Tighten the nuts finger tight.

(d) TORQUE the D-sump oil supply line aft B-nut at the turbine rear frame strut connection and the forward B-nut to between 450 and 550 lbf.in. (5.08 and 6.21 m.daN).

(e) TORQUE loop clamp nuts to between 33 and 37 lbf.in. (0.37 and

0.42 m.daN).
(f)Install spray shields.
(5)If removed, install the combustor drain line at the 7 o'clock position (Ref. Fig. 403).
(a)Install any removed loop clamps, bolts, and nuts.
(b)TORQUE loop clamp nuts to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN).
(c)TORQUE forward and aft combustor drain line B-nuts to between 180 and 200 lbf.in. (2.03 and 2.26 m.daN).
(6)Attach the LP recoup tubes as follows :
WARNING : THREAD COMPOUND LUBRICATING GREASE IS AN AGENT THAT IS AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN THREAD COMPOUND LUBRICATING GREASE IS USED. DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES. USE IN AN AREA OPEN TO THE AIR. CLOSE THE CONTAINER WHEN NOT USED.
(a)Lubricate the bolt threads with Material No.C02-002.
(b)Attach the 3 LP recoup tubes to the exhaust cone using 12 bolts coated with Material No.C02-002. TORQUE the bolts to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN).
(c)TORQUE the 12 bolts and nuts that attach the 3 LP recoup tubes to the compressor rear frame pads to between 55 and 70 lbf.in. (0.62 and 0.79 m.daN).
(d)TORQUE the 6 bolts and nuts that attach the 3 LP recoup tubes to the compressor rear frame and turbine rear frame brackets to between 55 and 70 lbf.in. (0.62 and 0.79 m.daN).
(e)TORQUE the 6 bolts and nuts that attach the 3 LP recoup tubes to the turbine rear frame brackets to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN).
(7)Attach the leads to the T5 sensor as follows :
(a)Reconnect the leads to the T5 sensor. Attach the lead clamps to the LPT manifold (5 places) and stator case bracket (1 place) using bolts, washers, and nuts.
R (b)TORQUE the smaller lead nut to between 12 and 14 lbf.in. (0.13 and
R 0.16 m.daN).
R (c)TORQUE the larger lead nut to between 20 and 30 lbf.in. (0.22 and
R 0.34 m.daN).
(d)TORQUE the lead clamp nuts to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN).
(8)Install, connect, or tighten any QEC equipment loosened, disconnected, or removed in step 3.B.(1).
End Post SB GE 75-122

D. Close-Up
(1)Remove safety clips and tags and close circuit breakers.
(2)Close the core cowl, fan reverser cowl, and fan cowl doors (Ref. 71-13-00, P. Block 301).
End Pre SB GE 75-148
Post SB GE 75-148

LPT COOLING AIR MANIFOLD - REMOVAL/INSTALLATION

1. General

A. This procedure will provide the instructions necessary for the removal and installation of the 6 segments making up the LPT cooling air manifold (birdcage).

2. Equipment and Materials

ITEM	DESIGNATION
A.	Piston Ring
B. Material No.C02-002	Anti-Seize Compounds, Lubricants, Oils (Ref. 70-00-00)
C. Material No.C02-033	Anti-Seize Compounds, Lubricants, Oils (Ref. 70-00-00)
Referenced Procedures	
- 70-00-00, P. Block 201	Standard Practices - Engine - General
- 71-13-00, P. Block 301	Cowl Doors

NOTE : If all 6 segments are not being removed and/or replaced, consult applicable IPC for specific expendable parts required.

3. Procedure

A. Job Set-Up
(1)Open the fan cowl, fan reverser cowl, and core cowl doors. (Ref. 71-13-00, P. Block 301).
(2)Open, safety and tag the appropriate circuit breakers.

B. Removal (Ref. Fig. 404, 405)
(1)Loosen, disconnect, or remove any QEC equipment necessary to gain access to the LPT cooling air manifold.
(2)Removal of the LPT Cooling Air Manifold Segments.
NOTE : Segments may be removed and/or replaced individually as required. This procedure is written assuming all segments are being removed.
(a)Disconnect the T5 electrical leads from the T5 sensor (Ref. Fig. 404) (Sheet 1).
(b)Working from the sensor forward, remove the nuts, washers, and bolts (4 places) securing the T5 sensor electrical lead to LPT case bracket (1 place) and LPT manifold (3 places). Carefully move the T5 sensor electrical lead aside to gain access to the LPT cooling air manifold.
CAUTION : DO NOT REMOVE THE RETAINING NUTS THAT ATTACH THE FORWARD AND AFT MANIFOLD BRACKETS TO THE LOW PRESSURE TURBINE CASE. REMOVING THESE NUTS CAN RESULT IN THE BOLTS FALLING INTO THE ENGINE CASE, FORCING A PREMATURE ENGINE REMOVAL.
(c)If necessary, remove bolts and nuts from the aft end of the support links attached to the LPT forward brackets.
(d)If necessary, remove the D-sump oil supply, D-sump oil scavenge, and combustor drain lines as follows (Ref. Fig. 403) :
1 Remove the spray shields and loosen the B-nuts at each end of the lines as necessary.

2 Remove any necessary bolts, nuts, and clamps that attach the lines to the turbine rear frame.

3 Remove any necessary bolts, nuts, and clamps that attach the lines to the LPT cooling air manifold.

4 Remove the D-sump oil supply, D-sump oil scavenge, and combustor drain lines as necessary.

(e) Beginning at the 10 o'clock position (aft looking forward) and working counterclockwise, remove the 2 nuts, bolts, and manifold clips securing the aft end of the manifold segment (No. 1) to the LPT stator case bracket (Ref. Fig. 404) (Detail G).

CAUTION : DO NOT REMOVE THE NUTS HOLDING THE LPT COOLING MANIFOLD BRACKET TO THE LPT CASE. THE RETAINER BOLT WILL FALL INTO THE LPT CASE CAVITY.

(f) Remove the bolt, cooling bushing, spring washer and manifold wear washer that attach the aft end of manifold segment (No. 1) to the LPT stator case bracket (Ref. Fig. 404) (Detail H).

(g) Remove the nut, and bolt securing the forward end of the manifold segment (No. 1) to the LPT stator case bracket (Ref. Fig. 404) (Detail E).

(h) Remove the bolt, bushing, spring washer, and manifold wear washer that attach the forward end of manifold segment (No. 1) to the LPT stator case bracket (Ref. Fig. 404) (Detail F).

(i) Loosen the aft manifold clips of the adjacent LPT manifold segments (8 and 12 o'clock positions) so that the clips are free of the LPT stator case brackets.

(j) Remove the bolt, cooling bushing, spring washer and manifold wear washer that attach the aft end of the adjacent manifold segments to the LPT stator case bracket (Ref. Fig. 404) (Detail H).

(k) Remove the nuts, and bolts securing the forward end of the adjacent LPT manifold segments to the stator case brackets.

(l) Remove the bolt, bushing, spring washer, and manifold wear washer that attach the forward end of the adjacent manifold segments to the LPT stator case bracket (Ref. Fig. 404) (Detail F).

(m) Remove the No. 1 manifold segment by carefully pulling outward, disconnecting the cooling air feeder tube from the adjacent manifold segments, then sliding aft until clear of the 7th stage cooling air manifold.

(n) Remove the 12 bolts securing the 3 LP recoup tubes to the exhaust cone.

(o) Loosen the 12 bolts and nuts securing the 3 LP recoup tubes to the pads of the compressor rear frame.

(p) To increase clearance, loosen the hardware attaching the 3 LP recoup tubes to compressor rear frame and turbine rear frame brackets.

(q) Remove the LPT inlet manifolds from air manifolds at 4 and 10 o'clock positions as follows :

1 Loosen the V-band clamp connecting the air manifold with the LPT inlet manifold and disengage from the tube joint.

2 Loosen the nuts, bolts, and manifold clips securing the manifold segment to LPT stator case aft bracket. Loosen this same hardware on the adjacent manifold segment (Ref. Fig. 404) (Detail G).

3 Remove the bolt, cooling bushing, spring washer and manifold wear washer that attaches the aft end of the manifold segment to the LPT

stator case bracket (Ref. Fig. 404) (Detail H).

4 Remove the nut, and bolt securing the adjacent manifold segment to the forward stator case bracket (Ref. Fig. 404) (Detail E).

5 Remove the bolt, bushing, spring washer, and manifold wear washer that attaches the forward end of the manifold segment to the LPT stator case bracket (Ref. Fig. 404) (Detail F).

6 Carefully pull the manifold segment outward disengaging the cooling feeder tubes from the adjacent manifold segment. Move aft until clear of the 7th stage cooling air manifold.

(r) Continue working in a counterclockwise direction removing the remaining LPT manifold segments.

NOTE : Removal of the LPT manifold segments beneath the oil supply and oil scavenge tubes should be accomplished without disturbing the oil tube coupling nuts to avoid pressure test of tubes.

(s) Remove piston ring from large tube on all LPT cooling air manifold segments.
Discard piston ring.

C. Installation (Ref. Fig. 404, 405)

(1) Installation of the LPT Manifold Segments.

(a) Lubricate the thick outer ring of the 6 piston rings with Material No.C02-033.

NOTE : Each piston ring is made up of a thin inner ring and a thick outer ring.

(b) Install one piston ring into each groove on the male end of the largest tube of each manifold segment.

1 Wrap the thin inner ring around and into the groove on the male end.

2 Hold the thin inner ring in place until the thick outer ring is installed.

CAUTION : BE SURE THAT THE GAP IN THE THIN INNER RING IS NOT ALIGNED WITH THE GAP IN THE THICK OUTER RING. EQUIPMENT FAILURE CAN RESULT.

3 Install the thick outer ring into the groove and over the thin inner ring. Be sure the gap in the thin inner ring is not aligned with the gap in the thick outer ring.

(c) LPT manifold segment No. 1 has two brackets welded to the plenum. Install that segment at the 2 o'clock position with the bracket at 3 o'clock (Ref. Fig. 405).

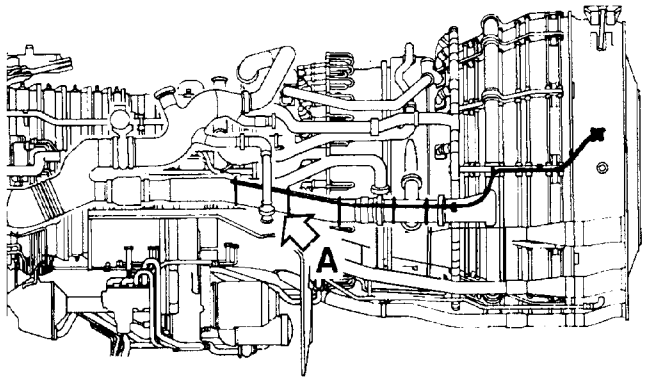
1 Put the middle section of manifold segment No. 1 into the forward bracket (Ref. Fig. 404) (Detail E) at the 2 o'clock position.

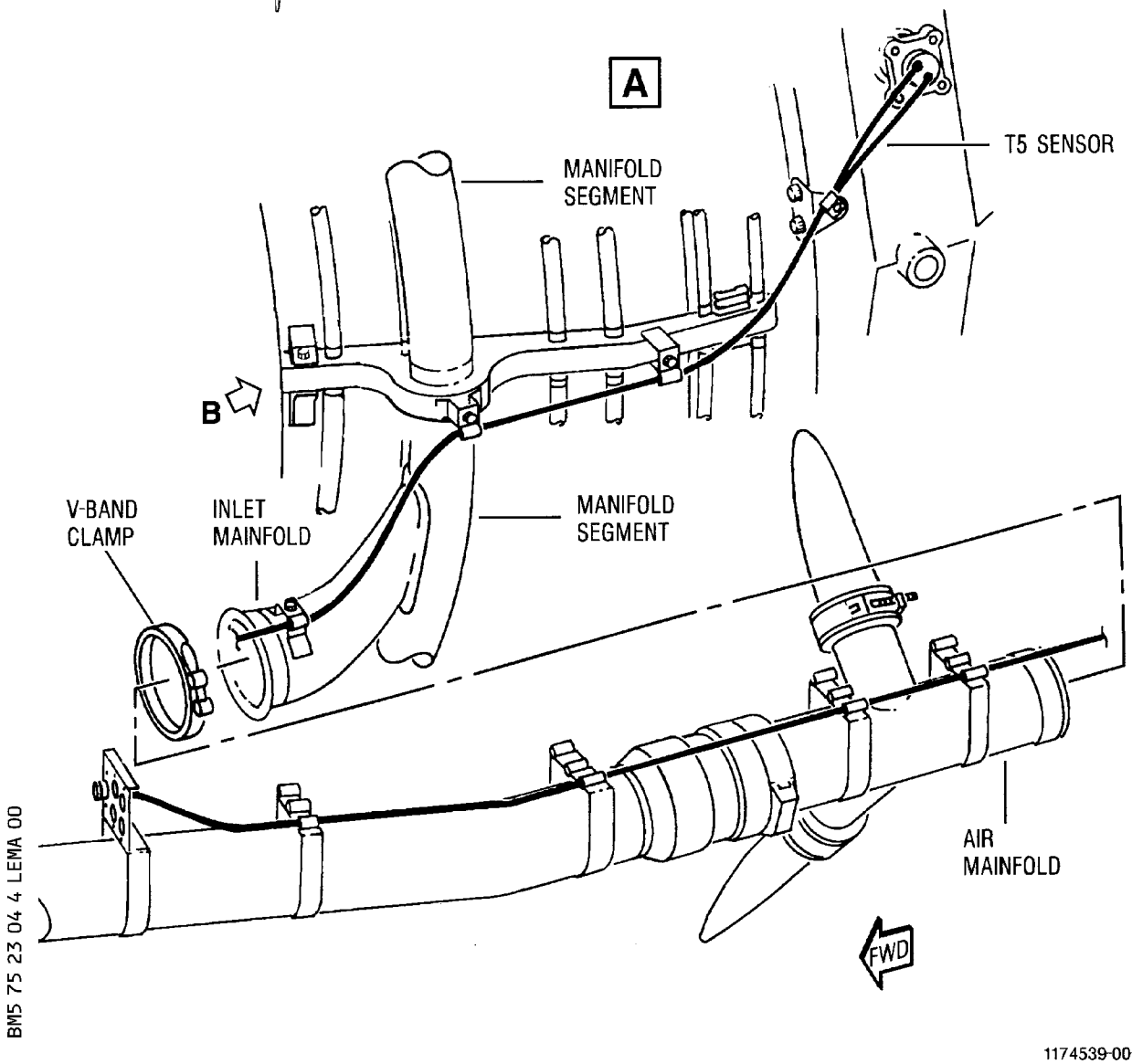
2 Align the forward bolt hole half at the 3 o'clock position in the segment with the bolt hole in the forward bracket (Ref. Fig. 404) (Detail F).

3 Loosely install manifold wear washer, spring washer, bushing, and bolt.

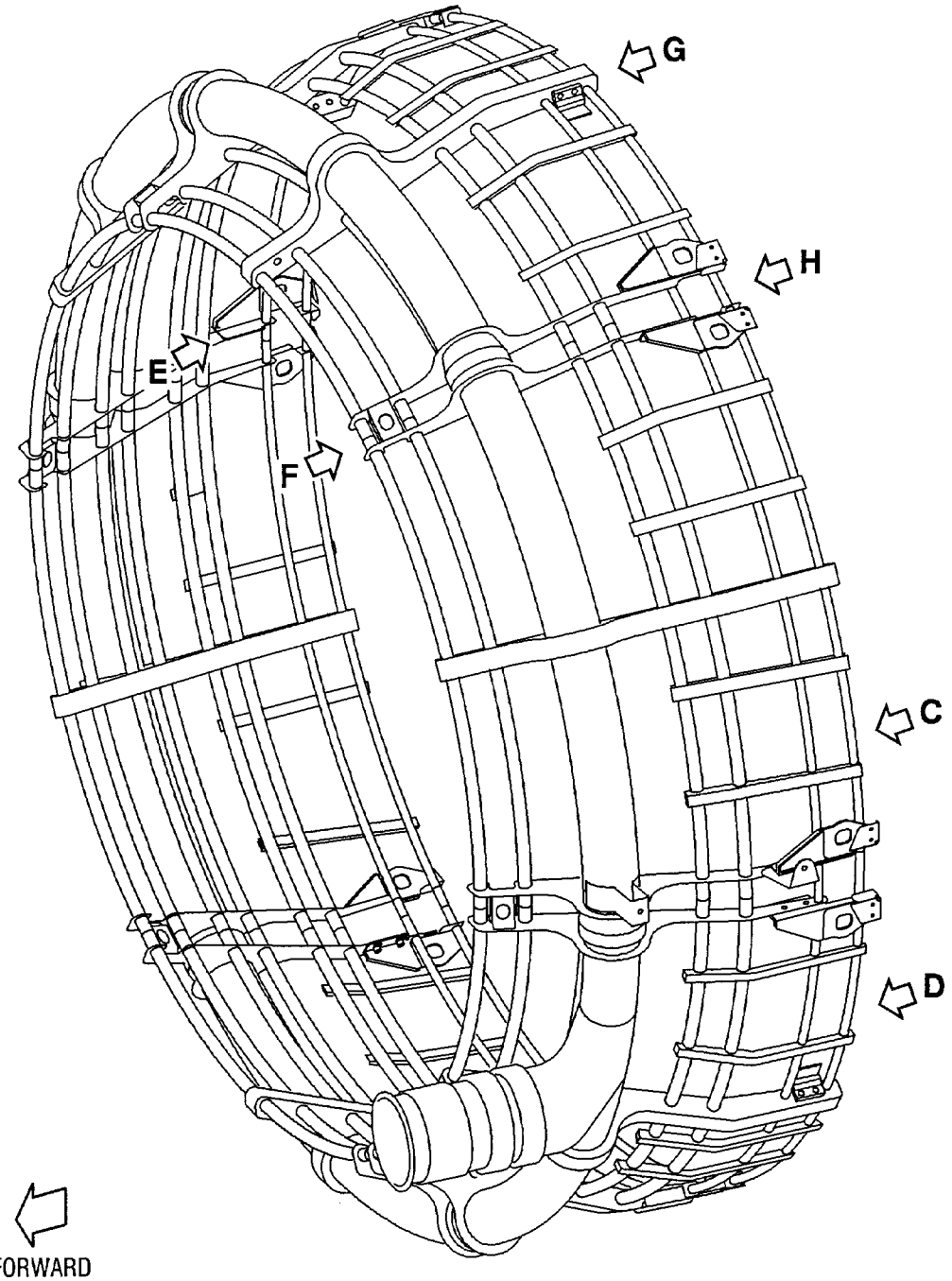
(d) Install LPT manifold segment No. 6 counterclockwise from the installed segment.

CAUTION : DO NOT FORCE SEGMENTS TOGETHER. IF ASSEMBLY IS DIFFICULT, CHECK THE PISTON RING FOR ENGAGEMENT IN THE GROOVE OF THE LARGE TUBE.





LPT Cooling Air Manifold - Removal/Installation
(Sheet 1/5)
Figure 404



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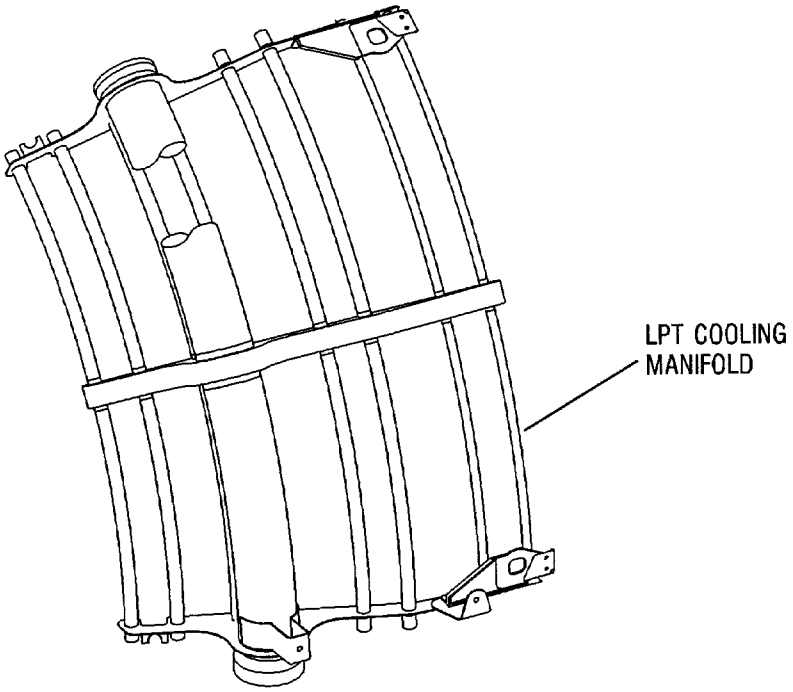
LPT Cooling Air Manifold - Removal/Installation
(Sheet 2/5)
Figure 404

C



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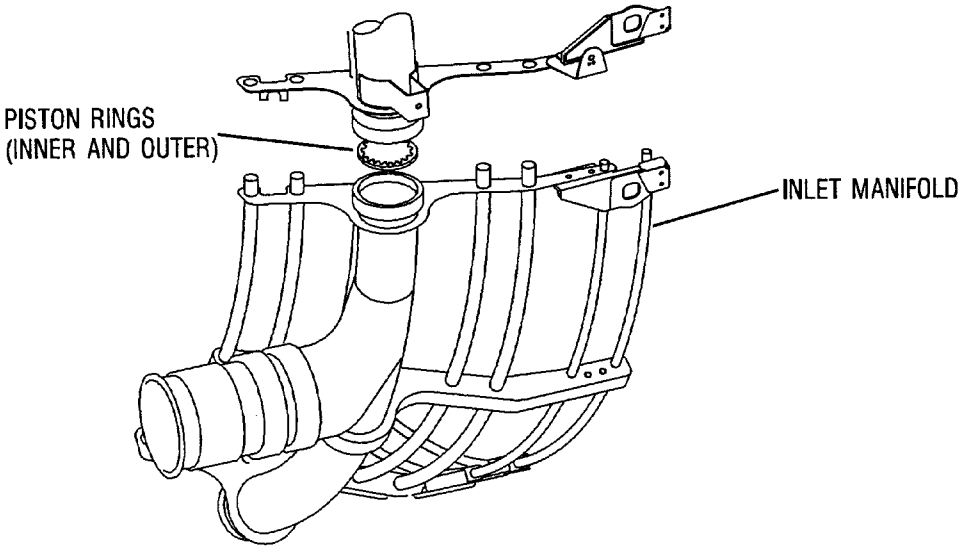

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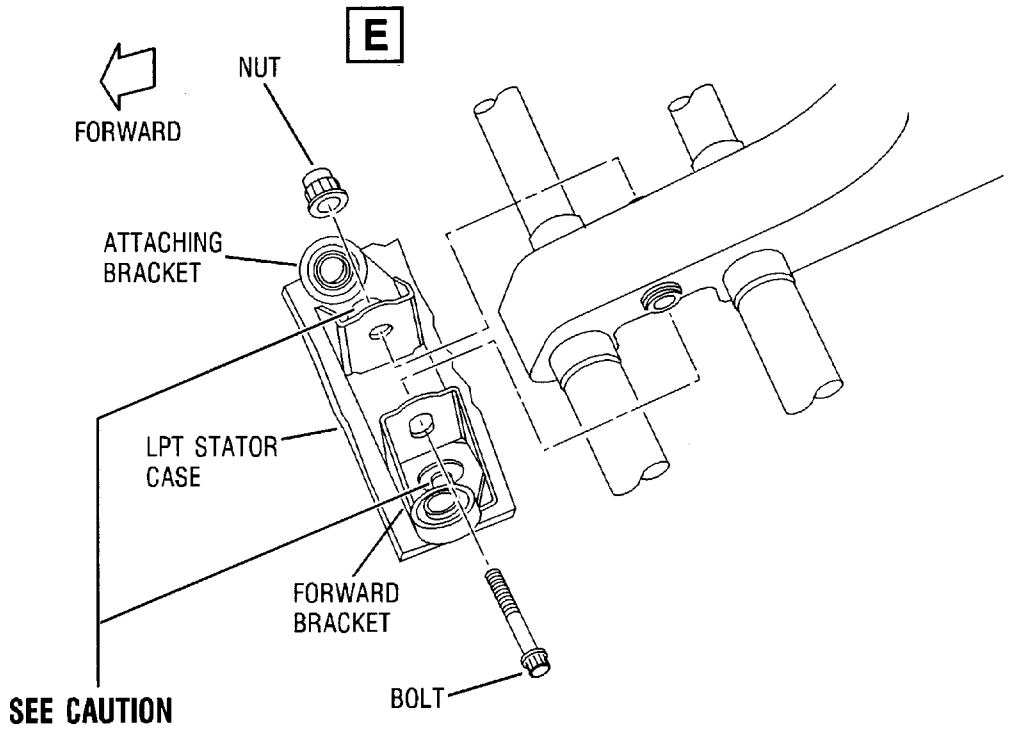
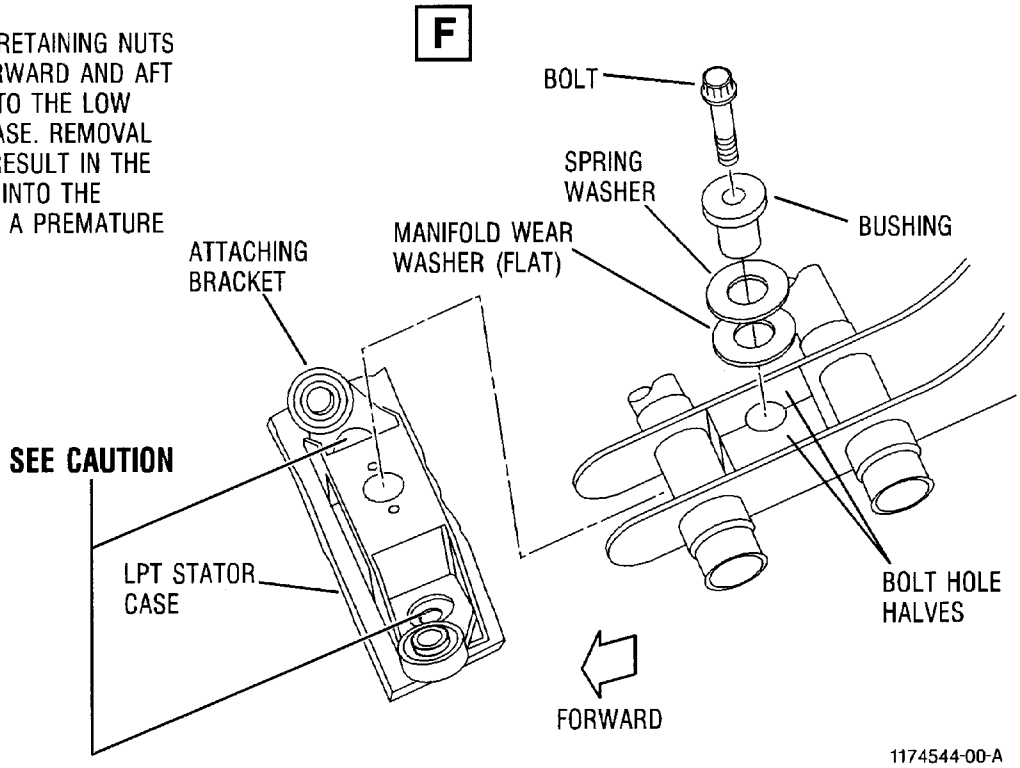
LPT Cooling Air Manifold - Removal/Installation
(Sheet 3/5)
Figure 404



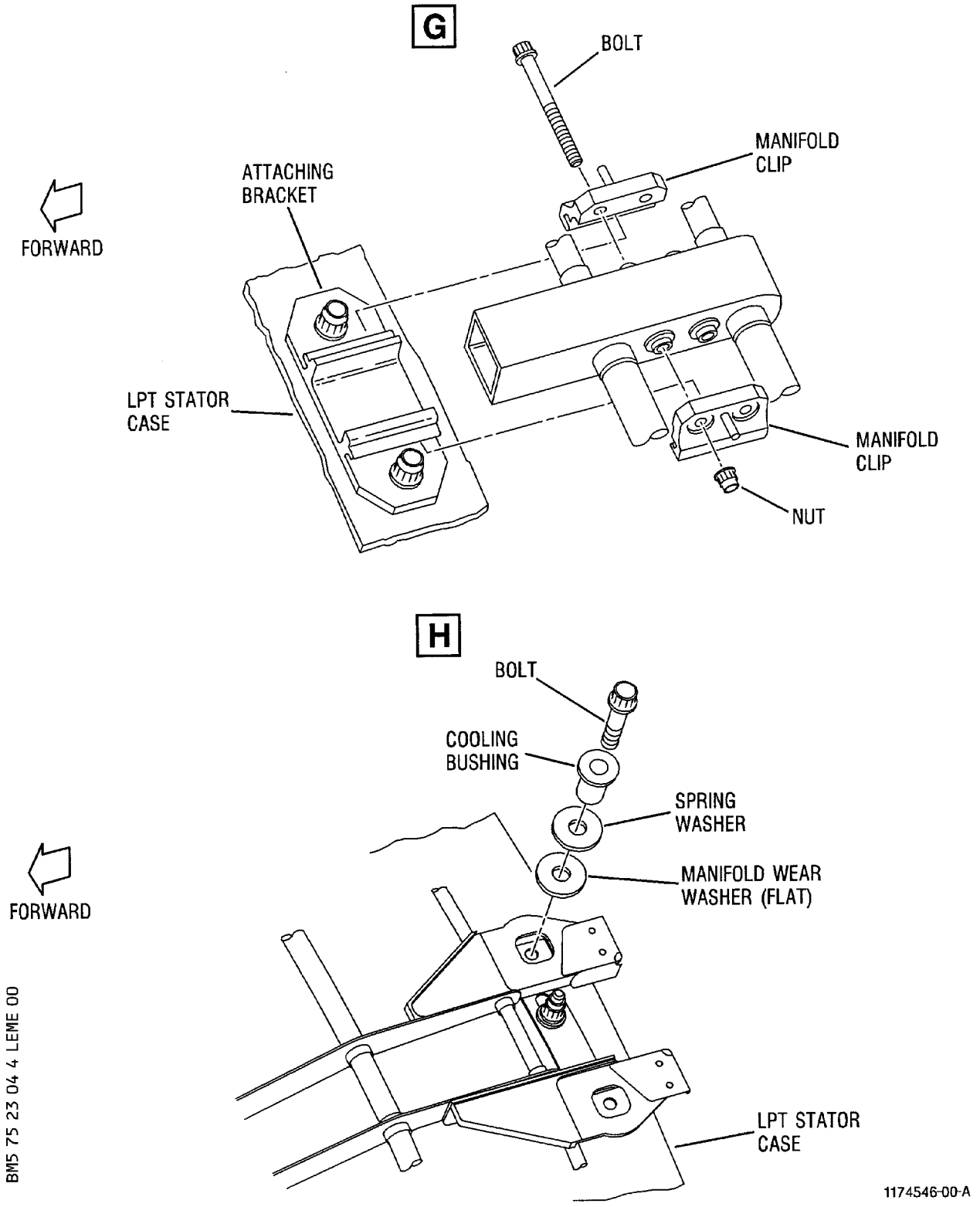
CAUTION:
DO NOT REMOVE THE RETAINING NUTS THAT ATTACH THE FORWARD AND AFT MANIFOLD BRACKETS TO THE LOW PRESSURE TURBINE CASE. REMOVAL OF THESE NUTS CAN RESULT IN THE INNER BOLTS FALLING INTO THE ENGINE CASE FORCING A PREMATURE ENGINE REMOVAL.

NOTE:
LINKS OMITTED FOR CLARTTY.

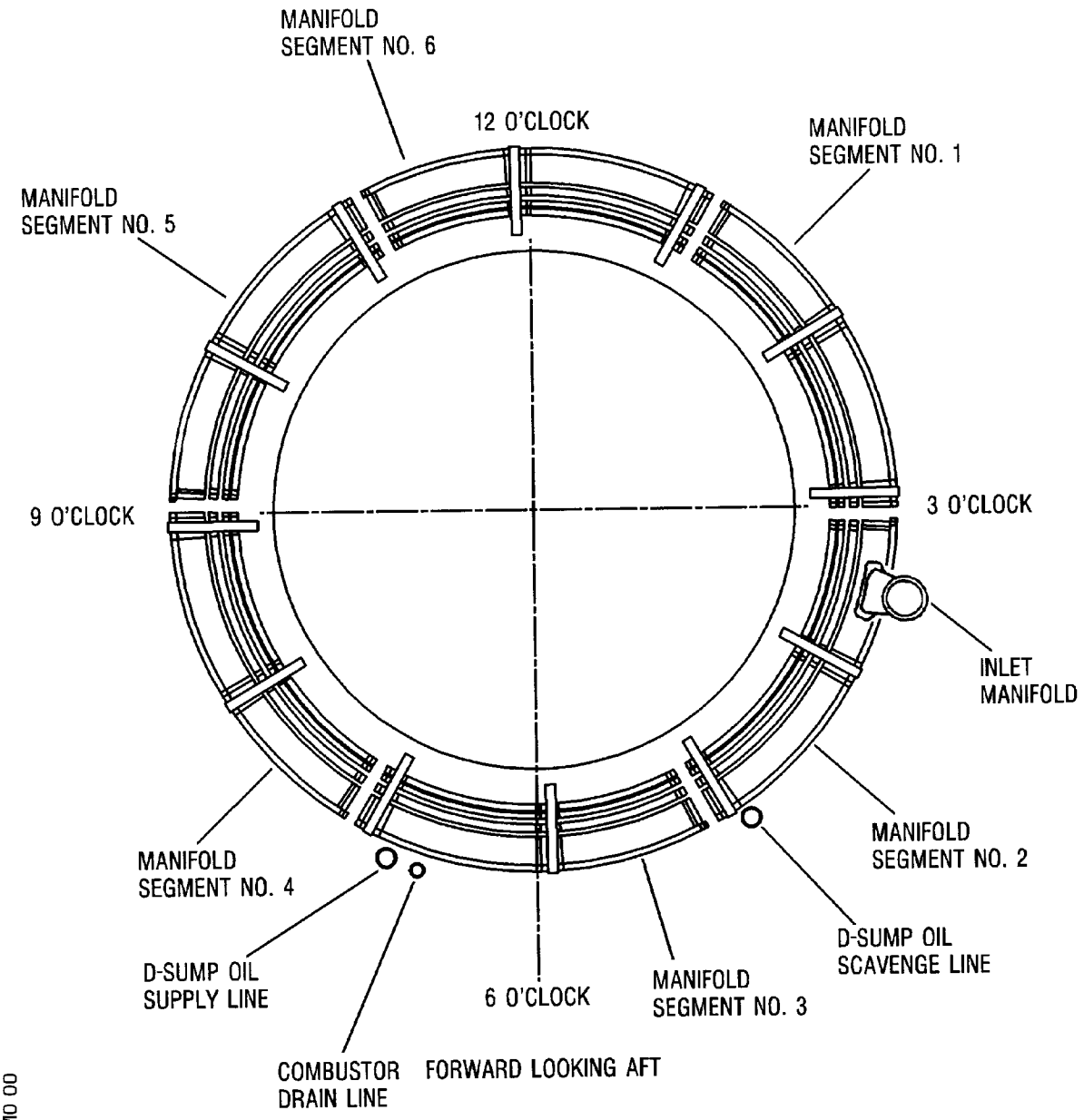


BM5 75 23 04 4 LEMD 00

LPT Cooling Air Manifold - Removal/Installation
(Sheet 4/5)
Figure 404



LPT Cooling Air Manifold - Removal/Installation
(Sheet 5/5)
Figure 404



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LPT Cooling Air Manifold - Segment Position
Figure 405

1 Align the tubes and gently push the large tube until the segment is aligned with the brackets on the LPT stator case. Be sure the forward bolt hole half slides under the washer installed with the previous segment. Loosen the bolt as necessary and then tighten it hand tight (Ref. Fig. 404) (Detail F).
2 Put the middle section of the segment into the forward bracket.
3 Align the other forward bolt hole in the segment with the bolt hole in the forward bracket (Ref. Fig. 404) (Detail F).
4 Loosely install washers, spring washer, bushing, and bolt.

(e) Repeat steps (c) and (d) to install the remaining segments. Install two inlet segments so that the inlet segments mate with the air supply tubes. Inlet manifold segment No. 2 is installed at 4 o'clock position and inlet manifold segment No. 5 is installed at 10 o'clock position (Ref. Fig. 405).

(f) Install the forward hardware as follows :
1 Install two washers, one bushing and one bolt in the forward holes at 1, 3, 5, 7, 9 and 11 o'clock positions (Ref. Fig. 405, 404) (Detail F).
2 Install one bolt and one nut in the forward holes at 2, 4, 6, 8, 10 and 12 o'clock positions (Ref. Fig. 405, 404) (Detail E). Tighten the bolts hand tight.

(g) Install the aft hardware as follows :
1 Install two manifold clips, bolts, and nuts in the aft holes at 2, 4, 6, 8, 10 and 12 o'clock positions (Ref. Fig. 404) (Detail G). Be sure the manifold clips straddle the case bracket and engage the bracket tabs with the slots in the clips.
2 Install two manifold wear washers, spring washers, cooling bushings, and bolts in the aft holes at 1, 3, 5, 7, 9 and 11 o'clock positions (Ref. Fig. 404) (Detail H).
3 TORQUE the 12 nuts at the aft 2, 4, 6, 8, 10 and 12 o'clock positions (Ref. Fig. 404) (Detail G) to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN).
4 TORQUE the 12 bolts at the aft 1, 3, 5, 7, 9 and 11 o'clock positions (Ref. Fig. 404) (Detail H) to between 55 and 70 lbf.in. (0.62 and 0.79 m.daN).

(h) TORQUE the six bolts at the forward 1, 3, 5, 7, 9 and 11 o'clock positions (Ref. Fig. 404) (Detail F) to between 55 and 70 lbf.in. (0.62 and 0.79 m.daN).

(i) TORQUE the six nuts at the forward 2, 4, 6, 8, 10 and 12 o'clock positions (Ref. Fig. 404) (Detail E) to between 55 and 70 lbf.in. (0.62 and 0.79 m.daN).

(j) Install the two V-band clamps (Ref. Fig. 404) and TORQUE the nuts to 25 lbf.in. (0.28 m.daN).

(k) With a plastic or other non-metallic mallet tap around the circumference of the coupling to make the V-band clamp tension even.

(l) Increase the torque and at the same time continue tapping around the circumference.

(m) When the torque is 50 lbf.in. (0.56 m.daN) tap around the V-band circumference once more.

(n) TORQUE the V-band clamp to 50 lbf.in. (0.56 m.daN).

(2) If removed, install links to the LPT forward brackets as follows :

WARNING : THREAD COMPOUND LUBRICATING GREASE IS AN AGENT THAT IS AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN THREAD COMPOUND LUBRICATING GREASE IS USED. DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES. USE IN AN AREA OPEN TO THE AIR. CLOSE THE CONTAINER WHEN NOT USED.

(a)Coat all bolts with Material No.C02-058.
(b)Install links to LPT forward brackets using bolts and nuts.
(c)TORQUE nuts to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN).

(3)If removed, install aft end of the D-sump oil scavenge line to the turbine rear frame fitting at the 5 o'clock position. Install the forward end to the D-sump scavenge oil line (Ref. Fig. 403).
(a)Tighten the coupling nuts finger tight.
(b)Install any removed clamps, bolts, and nuts. Tighten nuts finger tight.
(c)TORQUE D-sump lube scavenge line aft B-nut coupling at turbine rear frame strut fitting and forward B-nut coupling to between 650 and 770 lbf.in. (7.34 and 8.70 m.daN).
(d)TORQUE loop clamp nuts to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN).

(4)If removed, install the aft end of the D-sump oil supply line to the turbine rear frame fitting at the 7 o'clock position. Install the forward end to the D-sump oil supply line (Ref. Fig. 403).
(a)Tighten the coupling nuts finger tight.
(b)Install any removed loop clamps, bolts, and nuts.
(c)Tighten nuts finger tight.
(d)TORQUE the D-sump oil supply line aft B-nut at the turbine rear frame strut connection and the forward B-nut to between 450 and 550 lbf.in. (5.08 and 6.21 m.daN).
(e)TORQUE loop clamp nuts to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN).
(f)Install spray shields.

(5)If removed, install the combustor drain line at the 7 o'clock position (Ref. Fig. 403).
(a)Install any removed loop clamps, bolts, and nuts.
(b)TORQUE loop clamp nuts to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN).
(c)TORQUE forward and aft combustor drain line B-nuts to between 180 and 200 lbf.in. (2.03 and 2.26 m.daN).

(6)Attach the LP recoup tubes as follows :

WARNING : THREAD COMPOUND LUBRICATING GREASE IS AN AGENT THAT IS AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN THREAD COMPOUND LUBRICATING GREASE IS USED. DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES. USE IN AN AREA OPEN TO THE AIR. CLOSE THE CONTAINER WHEN NOT USED.

(a)Lubricate the bolt threads with Material No.C02-002.
(b)Attach the 3 LP recoup tubes to the exhaust cone using 12 bolts coated with Material No.C02-002. TORQUE the bolts to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN).
(c)TORQUE the 12 bolts and nuts that attach the 3 LP recoup tubes to the compressor rear frame pads to between 55 and 70 lbf.in. (0.62 and

0.79 m.daN).

(d)TORQUE the 6 bolts and nuts that attach the 3 LP recoup tubes to compressor rear frame and turbine rear frame brackets to between 55 and 70 lbf.in. (0.62 and 0.79 m.daN).

(e)TORQUE the 6 bolts and nuts that attach the 3 LP recoup tubes to the turbine rear frame brackets to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN).

(7)Attach the leads to the T5 sensor as follows :

(a)Reconnect the leads to the T5 sensor. Attach the lead clamps to the LPT manifolds (5 places) and stator case bracket (1 place) using bolts, washers, and nuts.

R (b)TORQUE the smaller lead nut to between 12 and 14 lbf.in. (0.13 and
R 0.16 m.daN).

R (c)TORQUE the larger lead nut to between 20 and 30 lbf.in. (0.22 and
R 0.34 m.daN).

(d)TORQUE the lead clamp nuts to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN).

(8)Install, connect, or tighten any QEC equipment loosened, disconnected, or removed in step 3.B.(1).

D. Close-Up

(1)Remove safety clips and tags and close circuit breakers.

(2)Close the core cowl, fan reverser cowl, and fan cowl doors (Ref. 71-13-00, P. Block 301).

End Post SB GE 75-148

COMPRESSOR CONTROL - DESCRIPTION AND OPERATION

1. General (Ref. Fig. 001)
The variable stator vane (VSV) system controls airflow (primary) through the compressor downstream of the booster. The variable stator vane actuators position the inlet guide vanes and stator vanes as directed by the main engine control. The variable bypass valve (VBV) system automatically schedules the total bypass opening by positioning the valves as a function of core engine speed and compressor inlet temperature.

2. Description

A. Variable Stator Vane System (Ref. Fig. 002)
VSV system positions the compressor variable vanes to the angles necessary to provide optimum compressor efficiency at all engine speeds. Fuel pressure from the main engine control (MEC) is used as the hydraulic medium to operate the VSV actuators.
The variable stator vane (VSV) actuation system consists of 2 hydraulic actuators, levers and linkage and a VSV feedback cable. One hydraulic actuator, lever and linkage is located on each side of the high pressure compressor. The feedback cable is connected to the left side VSV lever and is routed to the main engine control.

B. Variable Bypass Valve System (Ref. Fig. 003)
The 12 bypass valves open at scheduled conditions to permit some of the primary airflow that would normally go into the core engine to pass into the fan secondary air stream, thereby improving the matching of the high pressure compressor to the fan. The bypass valves are closed during takeoff and cruise operation and operate to a prescribed schedule during other flight conditions.
The variable bypass valve (VBV) system consists of 2 hydraulic actuators, a unison ring, 12 bypass valves, a feedback cable, and control and bellcranck linkage. The VBV system automatically schedules the total bypass opening by positioning the valves as a function of core engine speed and compressor inlet temperature.
(1)VBV actuators
The variable bypass valve (VBV) actuators are mounted on the fan frame between number 4 and 5 and 10 and 11 struts. The VBV actuators mechanically position the unison ring which controls the opening of the 12 VBV doors.
(2)Variable Bypass Valve Feedback Reset System
The VBV feedback reset system provides booster stall margin during altitude chops and reverser operation by resetting the bleed doors open as required.
(3)Operation (Ref. Fig. 004)

A. VSV Operation
(1)The MEC contains a scheduling 3-D cam which is rotated as a function of N2 and translated as a function of CIT. Movement of the 3-D cam positions the VSV pilot valve in the MEC which then ports high pressure fuel to the rod or head end of the VSV actuators and vents the other end to bypass

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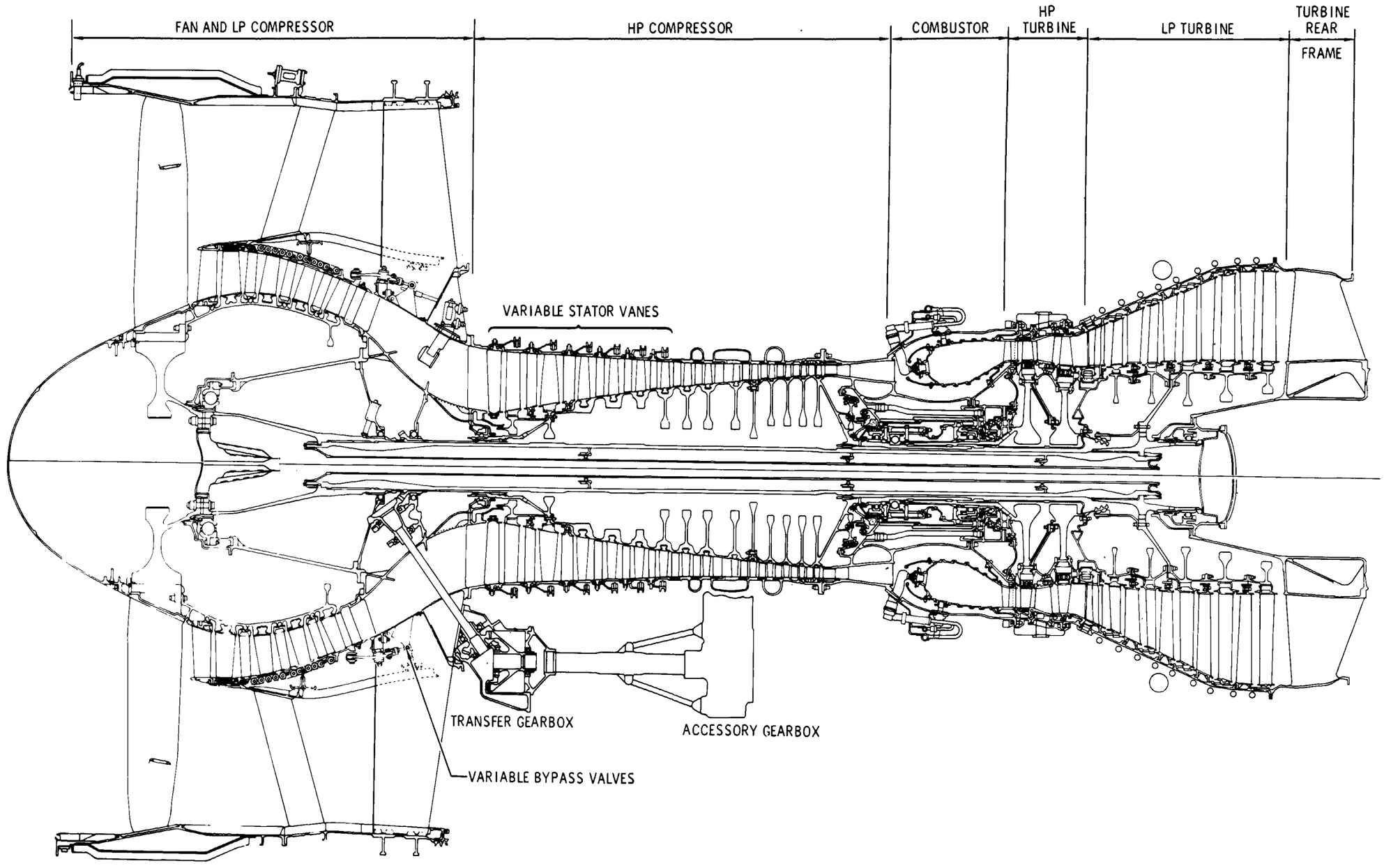

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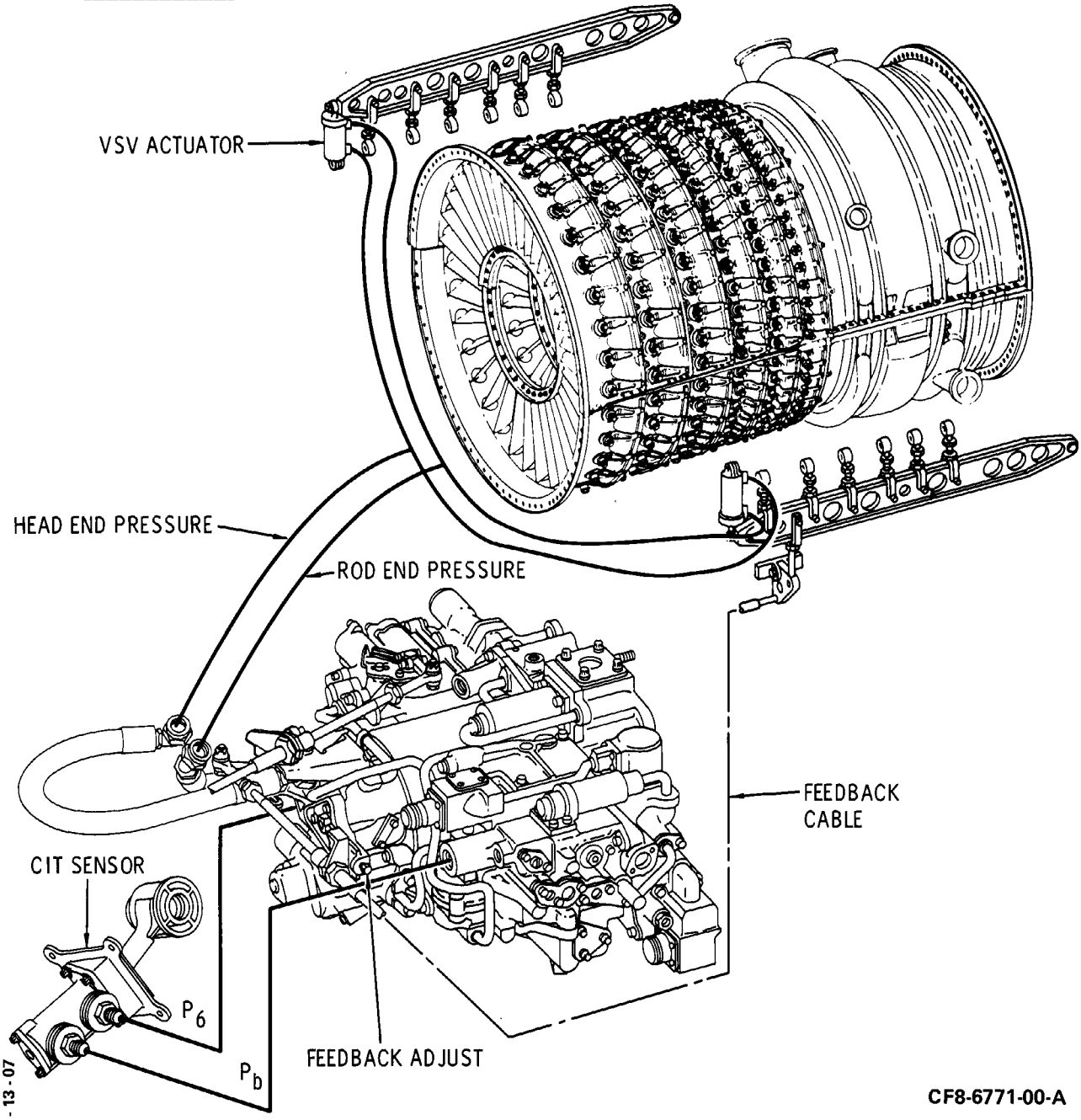
VSV and VBV System
Figure 001



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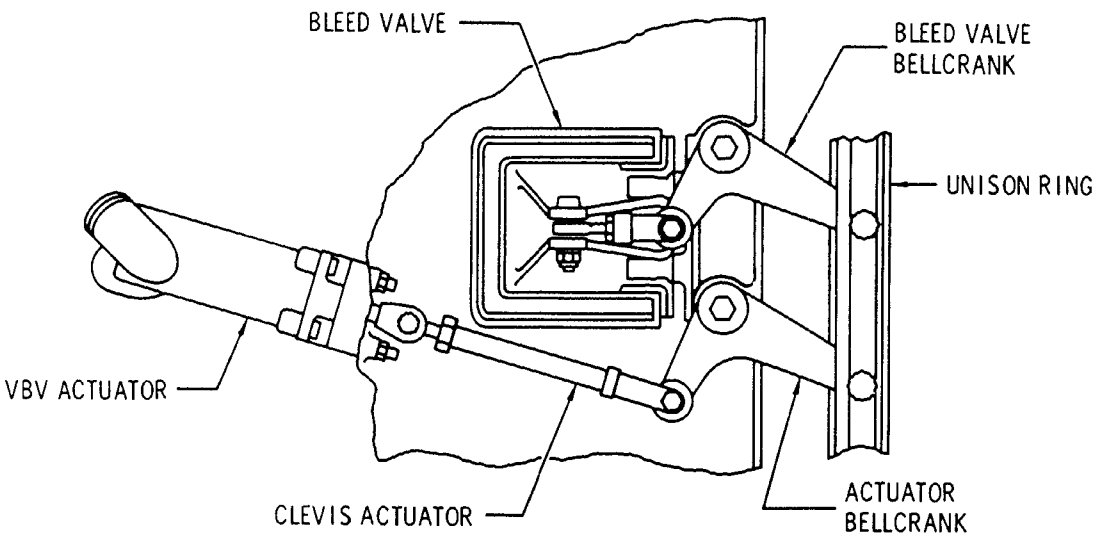
Variable Stator Vane Actuation System
Figure 002



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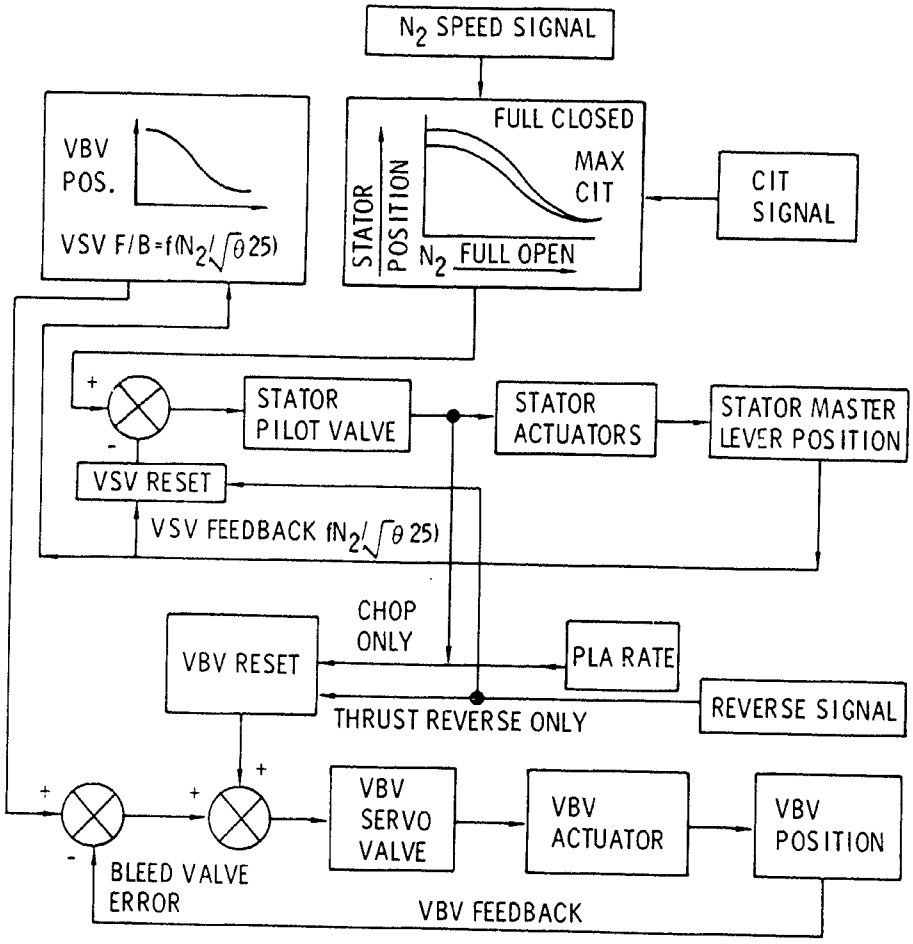
Variable Bypass Valve (VBV) System
Figure 003

pressure.

(2) The VSV feedback cable transmits a signal of actual stator vane position to the MEC to compare against the schedule. The VSV pilot valve is repositioned as a result of comparing scheduled position to actual position. Sensing any error, the MEC ports fuel pressure to the rod or head end of the VSV actuators to reposition the variable vanes to the desired schedule.

B. VBV Operation

Fuel pressures to operate the actuators are scheduled by the main engine control servo unit to provide a position of valve opening based on input from the variable stator vane feedback cable. Input from the bypass valve feedback cable to the VBV servo unit provides a position signal to compare against the predetermined schedule. Sensing any error between scheduled position and actual position, the servo unit ports-fuel pressure to the actuators to change the bypass valve position to agree with the schedule.



ABBREVIATIONS USED

CIT	COMPRESSOR INLET TEMPERATURE
N_2	HP ROTOR SPEED
LP	LOW PRESSURE CORRECTED TOTAL TEMP
θ25	AT CORE INLET
F/B	FEEDBACK
VBV	VARIABLE BLEED VALVE
VSV	VARIABLE STATOR VANE

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Compressor Control Block Diagram
Figure 004

VARIABLE STATOR VANE FEEDBACK CABLE - REMOVAL/INSTALLATION

1. General

This procedure pertains to the removal and installation of the Variable Stator Vane (VSV) feedback cable. Access to the VSV feedback cable is gained by opening the thrust reverser cowls.

2. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Torque Wrench 20-200 lbf. in. (0.23 - 2.26 m.daN.)
C.	Access Platform
Referenced Procedures	
- 71-00-00, P. Block 501	Power Plant - General
- 71-13-00, P. Block 301	Cowl Doors
- 75-31-01, P. Block 501	VSV Feedback Cable

3. Procedure

A. Job Set-Up

(1) Open, safety and tag the appropriate circuit breakers and open fan and thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).

(2) Install access platform.

B. Removal (Ref. Fig. 401)

CAUTION : ENSURE THAT CABLE END FITTINGS ARE CLEAN AND FREE OF FOREIGN MATERIAL TO AVOID DAMAGE TO ROD SEAL WHEN REMOVING SUPPORT TUBES.

(1) Remove bolt, washer, and nut securing VSV feedback cable to VSV bellcrank. Pull cable from bellcrank.

(2) Remove cotter pin, bolt, 2 washers, and nut securing VSV feedback cable to main engine control (MEC) lever arm.

(3) Remove rod end bearings from cable by removing lockwire and loosening jamnuts. Count and record number of turns necessary to remove rod end bearing.

(4) Remove VSV feedback cable as follows :

CAUTION : THE CABLE INNERMEMBER MUST BE IN FULLY RETRACTED POSITION WHENEVER SUPPORT TUBE AND NOSE CAP ARE REMOVED TO AVOID DAMAGE TO THE POLISHED INNERMEMBER. DO NOT REMOVE SUPPORT TUBE FROM BOTH ENDS OF CABLE AT SAME TIME.

(a) Slide cable innermember to fully retracted position at main engine control.

(b) Remove lockwire and remove the nose cap and support tube assembly from cable. Carefully remove cable from bracket on main engine control and then reinstall the nose cap and support tube assembly on cable fingertight.

(c) Slide cable innermember to fully retracted position (toward the main engine control) at the bellcrank end.

(d) Remove lockwire and remove the nose cap and support tube assembly from

cable and carefully remove cable from support bracket mounted on HPC stator case.

(e)Install nose cap and support tube assembly on cable fingertight.

C. Installation (Ref. Fig. 401)

(1)Install VSV feedback cable as follows :

(a)Secure both ends of VSV feedback cable as follows :

CAUTION : THE CABLE INNERMEMBER MUST BE IN FULLY RETRACTED POSITION WHENEVER SUPPORT TUBE AND NOSE CAP ARE REMOVED TO AVOID DAMAGE TO THE POLISHED INNERMEMBER. DO NOT REMOVE SUPPORT TUBE FROM BOTH ENDS OF CABLE AT THE SAME TIME.

1 At the bellcrank end, slide cable innermember to the fully retracted position toward MEC.

CAUTION : ENSURE THAT CABLE AND FITTINGS ARE CLEAN AND FREE OF FOREIGN MATERIAL TO AVOID DAMAGE TO ROD SEAL WHEN REMOVING SUPPORT TUBE

2 At the bellcrank end, remove support tube assembly and install cable in support bracket on HPC stator case. Secure with support tube assembly and nose cap and TORQUE nose cap to between 180 and 200 lbf.in. (2.03 and 2.26 m.daN.) and wirelock.

3 At the MEC end, slide cable innermember to the fully retracted position.

4 Remove nose cap and support tube assembly from cable end and install in support bracket on main engine control. Secure with support tube assembly and nose cap and TORQUE nose cap to between 180 and 200 lbf.in. (2.03 and 2.26 m.daN.) and wirelock.

NOTE : Clamps must not be used on VSV cable as they will cause cable to bind.

(b)Assemble rod-end bearing at each end of cable. TORQUE jamnut to between 20 and 30 lbf. in. (0.23 and 0.34 m.daN.) and wirelock.

NOTE : For ease of rigging, install rod-end bearing same number of turns as recorded in step B.(3).

NOTE : A pin of 0.055 inch (1.4 mm) diameter must not pass through witness hole in rod-ends after securing rod-ends in place.

(c)Connect VSV feedback cable to VSV bellcrank by installing bolt, washer, and nut. TORQUE nut to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN.).

(d)Connect VSV feedback cable to MEC by installing bolt, washer, and nut. TORQUE nut to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN.). Install cotter pin. Rod-end is installed on top of the MEC lever arm.

(e)Rig the VSV feedback system and check for proper operation (Ref. 75-31-01, P. Block 501).

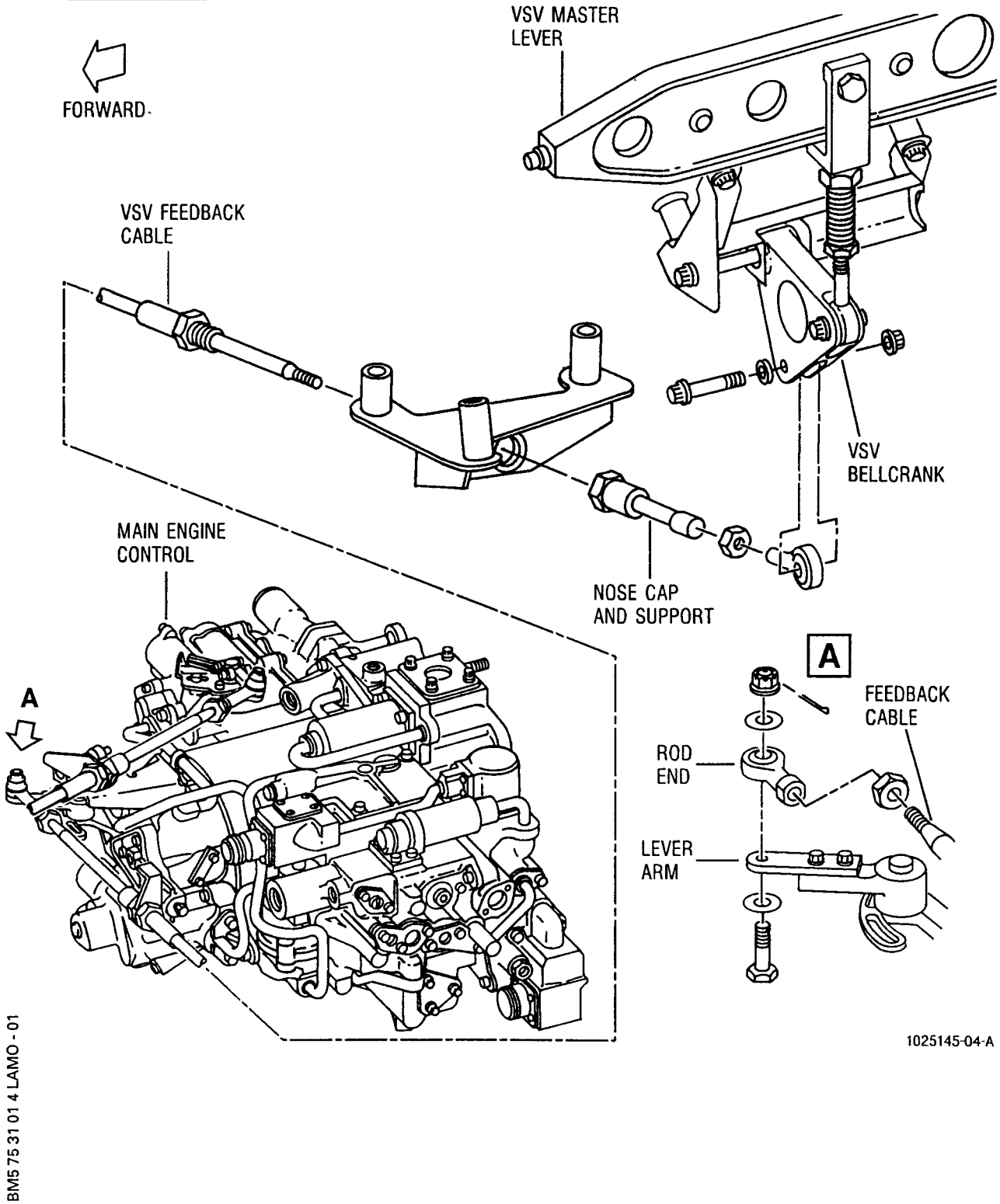
D. Close-Up and Test

(1)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.

(2)Remove access platform.

(3)Remove safety clips and tags and close circuit breakers close thrust reverser and fan cowl doors (Ref. 71-13-00, P. Block 301).

(4)Perform test as indicated in "Type of testing after engine component replacement" (Ref. 71-00-00, P. Block 501).



Variable Stator Vane Feedback Cable Installation
Figure 401

VARIABLE STATOR VANE FEEDBACK CABLE - ADJUSTMENT/TEST

1. General

CAUTION : DO NOT ATTEMPT UNAUTHORIZED ADJUSTMENTS. ENGINE DAMAGE CAN OCCUR.

The adjustments and tests given in this procedure are the only adjustments and tests authorized at the on-line maintenance level.

2. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Access Platform
Referenced Procedures	
- 71-13-00, P. Block 301	Cowl Doors
- 73-21-01, P. Block 501	Main Engine Control

3. Procedure

A. Job Set-Up

(1)Open, safety and tag the appropriate circuit breakers and open fan and thrust reverser cowl doors.

(2)Install access platform.

B. Adjustment/Test

(1)Rig (Ref. 73-21-01, P. Block 501).

(2)Rod-End Engagement Check.

If, during rigging VSV feedback system, it is necessary to extend length of feedback cable to the point that a pin of 0.055 in. (1.4 mm) diameter will pass through witness hole after securing rod-end in place and no trimmer bracket adjustment is available, replace cable.

(3)Support Tube Check.

Hand grasp and pull support tube at each end of feedback cable, pull in axial direction ; tube should not separate from base/cap of cable assembly ; repeat above except rotate support tube. If support tube separates or rotates more than 45 degrees total, replace cable.

C. Close-Up

(1)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.

(2)Remove access platform.

(3)Remove safety clips and tags and close circuit breakers.

Close cowl doors (Ref. 71-13-00, P. Block 301).

VARIABLE STATOR VANE FEEDBACK CABLE - INSPECTION/CHECK

1. General

This procedure provides instructions for inspection and check of variable stator vane feedback cable.

2. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Access Platform
Referenced Procedure - 71-13-00, P. Block 301	Cowl Doors

3. Procedure

A. Job Set-Up

(1) Open, safety and tag the appropriate circuit breakers and open fan and thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).

(2) Install access platform.

B. Inspection/Check

INSPECT/CHECK	MAXIMUM SERVICEABLE LIMITS	REMARKS
(1) Threaded Rod-Ends for :		
(a) Deformation or bends	None allowed	Replace cable assembly
(b) Scoring	None allowed	Polish
(2) Outer Conduit for :		
(a) Wire strands broken or worn through	None allowed	Replace cable assembly
(b) Missing RTV	None allowed	Replace RTV
(3) Support Tubes for :		
(a) Deformation, dents, bends	None allowed if causing interference with inner-member	Replace support tube per Approved Repairs
(4) Brackets and Clamps Related to Cable Attaching Points for :		
(a) Deformed, bent, or broken brackets	None allowed	Replace
(b) Deformed or worn loop clamps	None allowed	Replace

C. Close-Up

(1) Make certain that working area is clean and clear of tools and miscellaneous items of equipment.

(2) Remove access platform.

(3) Remove safety clips and tags and close circuit breakers.

Close thrust reverser and fan cowl doors (Ref. 71-13-00, P. Block 301).

VARIABLE STATOR VANE FEEDBACK CABLE - APPROVED REPAIRS

1. General

CAUTION : DO NOT ATTEMPT UNAUTHORIZED REPAIRS. ENGINE DAMAGE CAN OCCUR. Approved repairs given in this procedure are the only repairs authorized at the on-line maintenance level.

2. Equipment and Materials

ITEM	DESIGNATION
A.	Access Platform
B.	Circuit Breaker Safety Clips
Referenced Procedures	
- 71-13-00, P. Block 301	Cowl Doors
- 73-21-01, P. Block 501	Main Engine Control

3. Procedure

A. Job Set-Up
(1)Open safety and tag the appropriate circuit breakers and open cowl doors (Ref. 71-13-00, P. Block 301).
(2)Install access platform.

B. Replacement of Nose Cap and Support Tube Assembly
(1)Removal
(a)Disconnect VSV feedback cable rod-end from VSV bellcrank and/or MEC lever arm as applicable by removing cotter pin, nut, two washers, and bolt.
NOTE : When removing VSV feedback cable rod-end, count and record number of turns for ease of re-installation.
(b)Remove rod-end from VSV cable by removing lockwire and loosening jamnut.
CAUTION : ONE SUPPORT TUBE ASSEMBLY SHOULD ALWAYS REMAIN INSTALLED SO THAT THE INNER MEMBER IS PROTECTED. RETRACTION OF THE INNER MEMBER WHILE REMOVING THE SECOND SUPPORT TUBE ASSEMBLY WOULD EXPOSE THE INNER MEMBER TO POSSIBLE DAMAGE.
CAUTION : DO NOT ALLOW DIRT OR FOREIGN MATTER TO ENTER EXPOSED END OF CABLE. DO NOT USE ANY LUBRICANT ON CABLE.
(c)With cable end (on which nose cap and support tube assembly are being replaced) in retracted position, remove support tube assembly from MEC bracket by removing safetywire, and with two wrenches remove nose cap and support tube assembly from cable.
NOTE : If the inner member of the cable is not in the retracted position, (Ref. 73-21-01, P. Block 501) to hydraulically reposition the VSV feedback cable. Otherwise, disconnect the other end of the VSV feedback cable and manually reposition the inner member.
(2)Installation
(a)Slide new nose cap and support tube assembly onto cable assembly.
(b)Secure rod-end and VSV feedback cable.

C. Close-Up

(1)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.

(2)Remove access platform.

(3)Close cowl doors (Ref. 71-13-00, P. Block 301). Remove safety clips and tags and close circuit breakers.

VARIABLE STATOR VANE ACTUATOR - REMOVAL/INSTALLATION

1. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B. Material No.C02-021	Anti-Seize Compounds, Lubricants, Oils (Ref. 70-00-00)
C. Material No.C05-005	Inspection and Marking Compounds (Ref. 70-00-00)
D.	Corrosion Resistant Steel Lockwire
Referenced Procedures	
- 71-00-00, P. Block 501	Power Plant - General
- 71-13-00, P. Block 301	Cowl Doors

2. Procedure

A. Job Set-Up
Open, safety and tag the appropriate circuit breakers and open thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).

B. Removal (Ref. Fig. 401)
WARNING : EXPOSURE OF THE SKIN TO ENGINE FUEL MAY BE DETRIMENTAL. WASH SKIN THOROUGHLY AFTER CONTACT AND REMOVE SATURATED CLOTHING IMMEDIATELY.

R (1)Disconnect rod and head-end shroud ferrules and slide them back to expose tube nuts.
R (2)Place a suitable container under drain line and disconnect drain fitting.
R Drain the system.
(3)Disconnect rod and head-end tube nuts.
R (4)Loosen first clamps on tubes to ease removal of actuator.
(5)Remove nut and bolt securing actuator clevis to mounting bracket.
(6)Swing VSV actuator away from engine.
R (7)Remove the 5 nuts and bolts securing mounting bracket to fan frame flange.
(8)Slide mounting bracket off of actuator guide.
(9)Turn actuator guide 90 degrees and remove it from actuator lever.
(10)Remove VSV actuator.
R (11)Remove and discard preformed packings from shroud ferrules.
R (12)Remove and discard preformed packings from shroud tubes.
R (13)Remove nipples from rod and head-end ports of VSV actuators.
R (14)Remove and discard preformed packings from nipples.

C. Installation (Ref. Fig. 401)
(1)Lubricate preformed packing with oil (C02-021) and install on rod and
R head-end nipples.
R (2)Install nipples in VSV actuator ports and TORQUE to between 135 and 150 lbf.in. (1.53 and 1.69 m.daN).
(3)Slide VSV actuator rod onto actuator lever.
CAUTION : ACTUATOR GUIDE DEEPEST COUNTERBORE MUST FACE FORWARD DURING

INSTALLATION. INCORRECT ASSEMBLY CAN CAUSE SYSTEM TO BIND.

(4) Install actuator guide, deepest counterbore forward, onto actuator lever and then turn guide 90 degrees.

(5) Slide mounting bracket over actuator guide and attach bracket to fan frame flange with 5 bolts and nuts. Bolts are installed from aft side of flange through the brackets. TORQUE nuts to between 200 and 210 lbf.in. (2.26 and 2.37 m.daN).

CAUTION : MAXIMUM INSTALLATION TORQUE MUST NOT BE MORE THAN 130 LBF.IN. (1.47 m.daN).

(6) Attach the VSV actuator clevis to the mounting bracket with a nut and bolt. The bolt installs from the forward side. TORQUE the nut to between 65 and 75 lbf.in. (0.73 and 0.85 m.daN).

(7) Lubricate the new preformed packings with oil (C02-021) and install in grooves on the shroud tube.

(8) Lubricate new preformed packings with oil (C02-021) and install in grooves in seating face of shroud ferrules.

(9) Connect rod and head-end tubes to ports on VSV actuators. TORQUE tube nuts to between 135 and 150 lbf.in. (1.53 and 1.69 m.daN).

(10) Do a pressure test on the rod and head-end tubes for a leak as follows :

(a) Introduce dry air, nitrogen or argon at a pressure of 200 psig (13.79 bars) through the fuel supply line.

(b) Apply fluid (C05-005) or soap solution to each of the tube connections.

(c) No leaks are permitted.

(11) Slide shroud ferrules into place against VSV actuator ports; hand-tighten.

(12) Pressure test on the shrouds for leaks as follows :

(a) Introduce dry air, nitrogen or argon at a pressure of 50-55 psig (3.45-3.79 bars) through the overboard drain fitting. The drain fitting is located at forward left side of the accessory enclosure.

(b) Shut off the pressure supply when at the maximum permitted pressure.

(c) Monitor the pressure for 2 minutes. Maximum of 10 psig (0.7 bar) decrease is permitted.

(d) If the pressure is more than the limit, examine for leaks at all the shroud connections. Use fluid (C05-005) or soap solution. Make sure all the hex nuts are tightened to the correct torque; hand-tighten knurled nuts. Do not try to stop leakage by overtightening the connections.

(e) If leakage continues, replace the preformed packing in the areas of leakage.

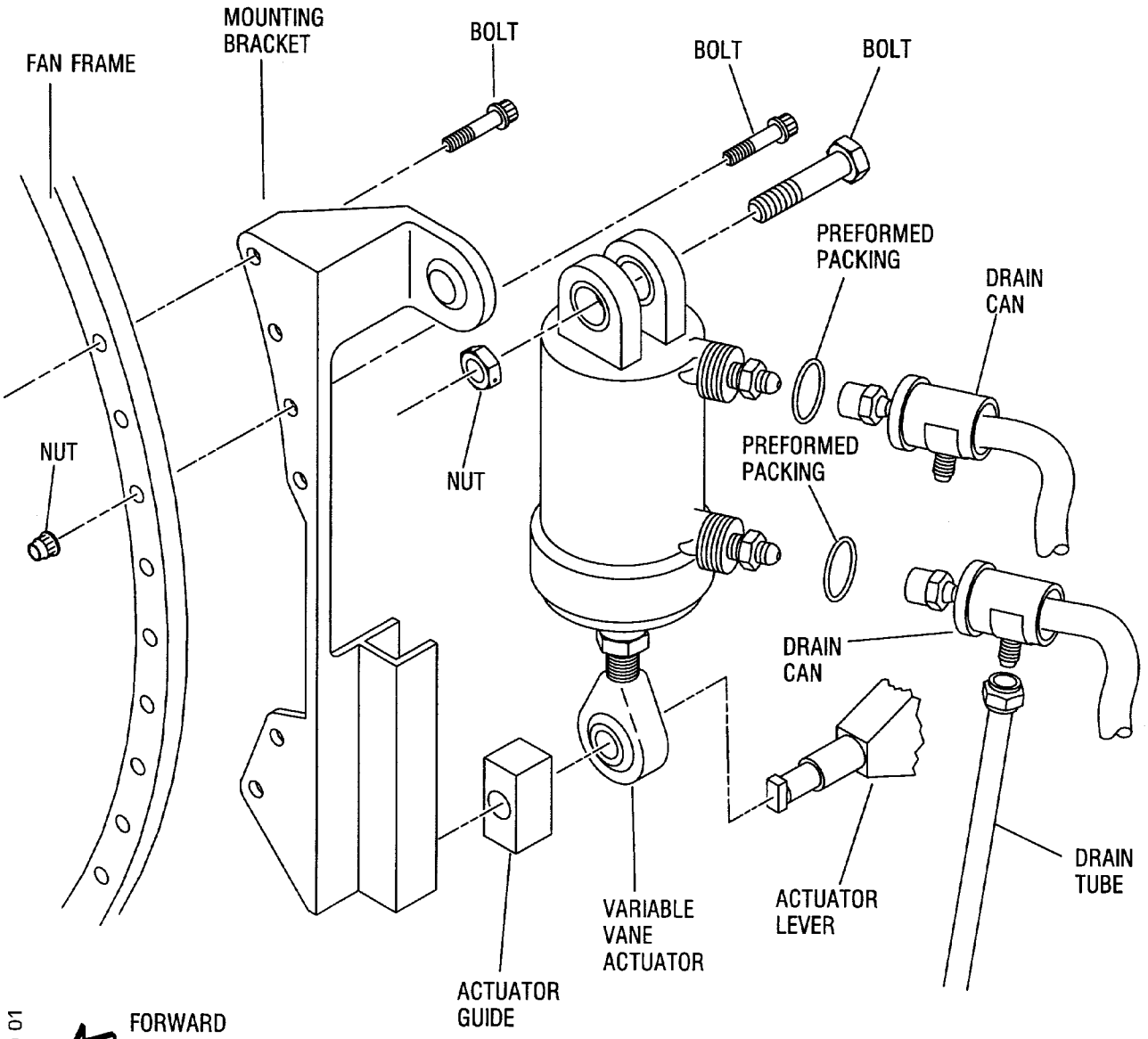
(f) Repeat the pressure test for leaks after replacement of the preformed packings.

D. Close-Up and Test

(1) Remove safety clips and tags and close the applicable circuit breakers, close thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).

(2) Perform test as indicated in "Type of testing after engine component replacement" (Ref. 71-00-00, P. Block 501).

NOTE:
LEFT SIDE SHOWN



Variable Stator Actuator
Figure 401

VARIABLE STATOR VANE ACTUATOR - INSPECTION/CHECK

1. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
Referenced Procedure - 71-13-00, P. Block 301	Cowl Doors

2. Procedure

A. Job Set-Up

Open, safety and tag the appropriate circuits breakers and open fan and thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).

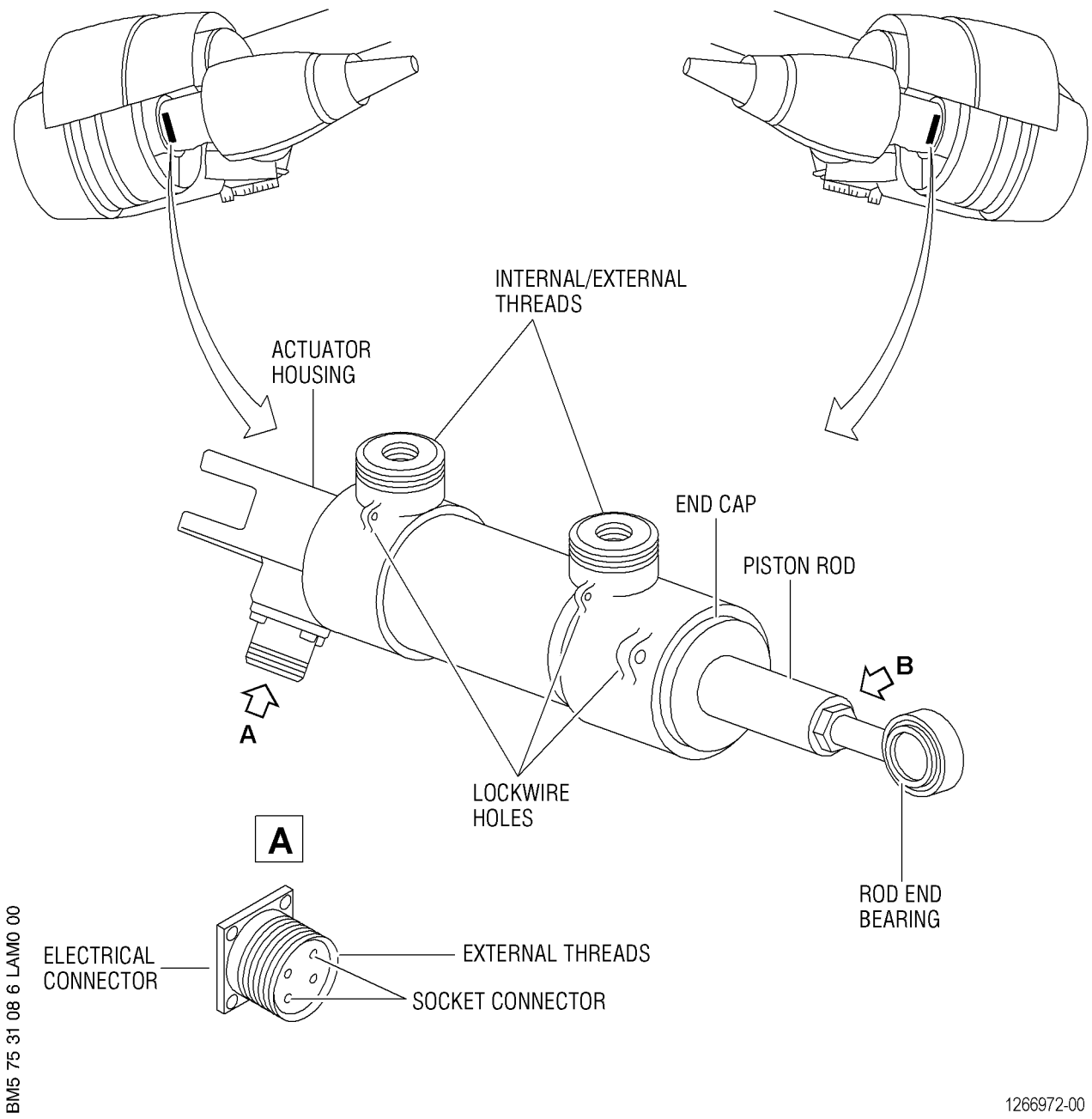
B. Inspection/Check

INSPECT/CHECK	MAXIMUM SERVICEABLE LIMITS	REMARKS
(1) Fuel Leakage :		
(a) From end cap	Not serviceable	Replace actuator
(b) From overboard drain	90 cc per hour 1.5 cc per minute/35 drops per minute	Replace actuator
(2) Actuator Housing for :		
(a) Heat dis-coloration	Not serviceable	Replace actuator
(b) Deformation, dents	Not serviceable	Replace actuator
(c) Nicks, scratches	Any amount not deforming housing	Replace actuator
(3) Threaded Connectors for :		
(a) Stripped threads	Not serviceable	Replace actuator
(b) Nicks, dents in threads	Any amount not to complete depth of thread. No high metal allowed	Chase threads or Replace actuator
(4) Piston Rod for :		
(a) Scoring	Not serviceable	Replace actuator
(b) Bending	Not serviceable	Replace actuator
(c) Stripped threads	Not serviceable	Replace actuator

INSPECT/CHECK	MAXIMUM SERVICEABLE LIMITS	REMARKS
(5) Rod-End Bearing for :		
(a) Binding of ball	Not serviceable	Replace actuator
(b) Wear of ball	Not serviceable	Replace actuator
(c) Nicks in ball	Not serviceable	Replace actuator
R (6) Locking nut and locking key for: (see NOTE 1)		
R (a) Locking nut loose or worn or missing lockwire	Not serviceable	Replace VSV Actuator
R (b) Locking key worn or missing	Not serviceable	Replace VSV Actuator
R (c) Locking nut and key installed incorrectly	Not serviceable	Replace VSV Actuator

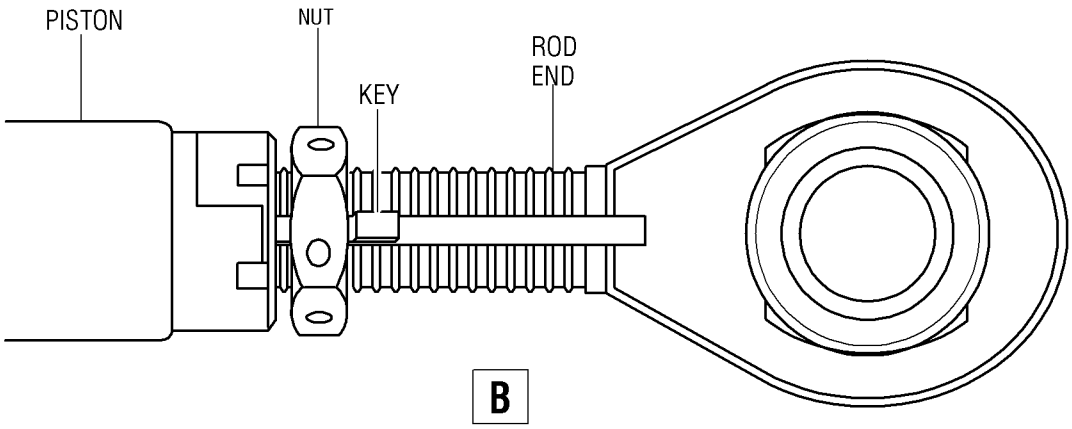
R NOTE 1 : (Ref. Fig. 601, 602).

C. Close-Up
(1)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.
(2)Remove safety clips and tags and close circuit breakers. Close thrust reverser and fan cowl doors. (Ref. 71-13-00, P. Block 301).



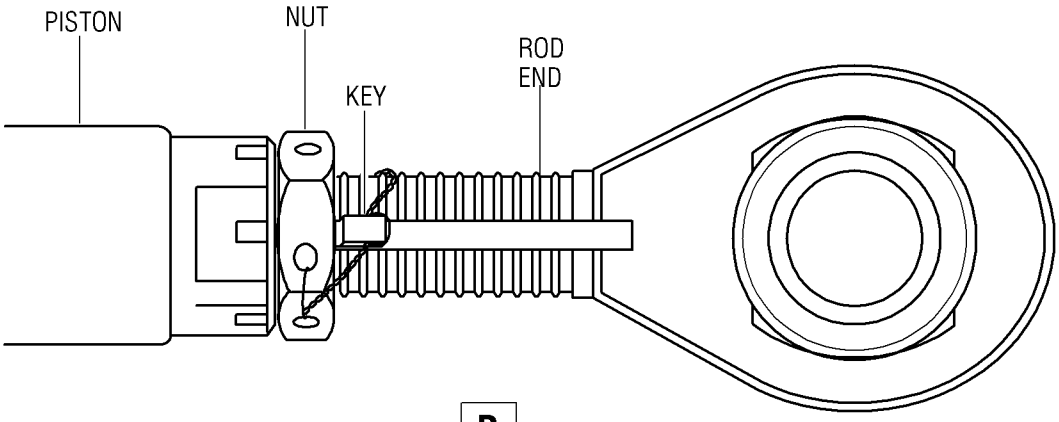
R

VSV Actuator
Figure 601



B

INCORRECT KEY INSTALLATION
LOCKWIRE MISSING



B

CORRECT KEY INSTALLATION
LOCKWIRE INSTALLED

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R

Correct and Incorrect Key Installation
Figure 602

VARIABLE BYPASS VALVE ACTUATOR - REMOVAL/INSTALLATION

1. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B. Material No.C02-021	Anti-Seize Compounds, Lubricants, Oils (Ref. 70-00-00)
C. Material No.C05-005	Inspection and Marking Compounds (Ref. 70-00-00)
D.	Corrosion Resistant Steel Lockwire
E.	Torque Wrench 55-150 lbf.in. (0.6 - 1.7 m.daN)
Referenced Procedures	
- 71-00-00, P. Block 501	Power Plant - General
- 71-13-00, P. Block 301	Cowl Doors

2. Procedure

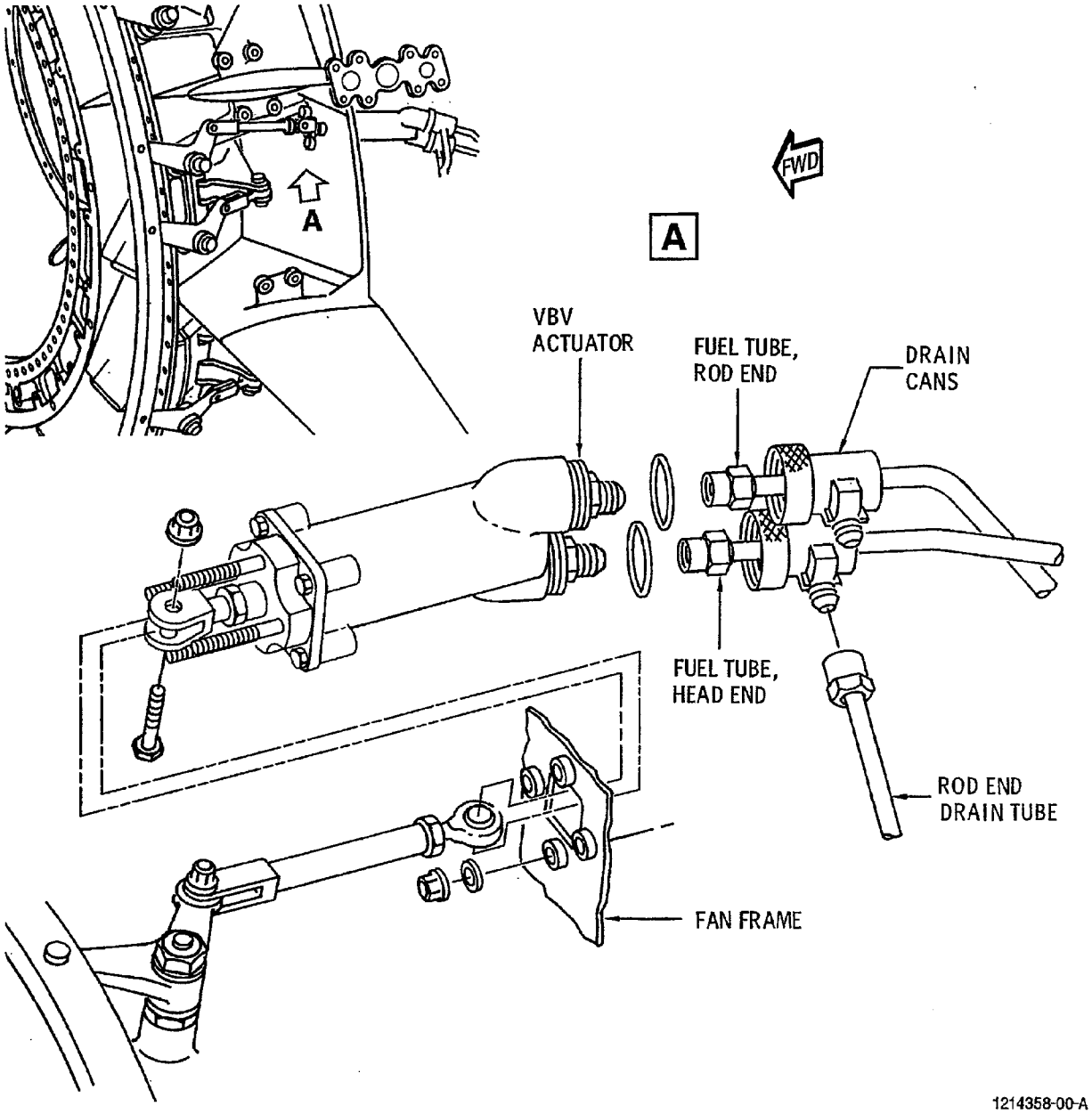
A. Job Set-Up
Open, safety and tag the appropriate circuits breakers and open fan and thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).

B. Removal (Ref. Fig. 401)
(1)Remove the 4 screws securing the liner segment between struts 4 and 5 or 10 and 11 to gain access to nuts securing actuator to fan frame.
(2)Disconnect drain tube from VBV drain can head end.
(3)Remove safety wire from knurled nuts on drain cans and disconnect. Slide knurled nuts back to expose fuel tubes.
(4)Disconnect fuel tubes from actuator.
(5)Remove nut and bolt from VBV actuator rod end clevis.
(6)Remove nuts and washers from actuator studs.
(7)Remove actuator from fan frame.
(8)Remove unions and preformed packings from actuator. Discard preformed packings.
(9)Remove preformed packings from shroud ferrules and shroud tubes. Discard preformed packings.

C. Installation (Ref. Fig. 401)
NOTE : Prior to installation of actuator, head and rod-end grommets must be in place in fan frame.
(1)Lubricate new preformed packings with oil (C02-021) and install. Install nipples in rod and head-end ports of actuator and TORQUE to between 135-150 lbf.in. (1.5 and 1.7 m.daN).
(2)Position VBV actuator on fan frame. Install washer and nut on each mounting stud. TORQUE bolt and nuts to between 55-70 lbf.in. (0.6 and 0.8 m.daN).
(3)Attach VBV actuator rod-end clevis to actuation ring linkage with bolt
R and nut. Align bolt hole radially outwards (towards fan strut) with bolt
R head oriented inwards. TORQUE nut to between 100 and 130 lbf.in.

(1.1 and 1.5 m.daN).
(4)Lubricate new preformed packings with oil (CO2-021) and install in groove on shroud tubes.
(5)Lubricate new preformed packings with oil (CO2-021) and install in groove on seating face of shroud ferrules.
(6)Connect fuel tubes to rod and head-end ports of actuator and TORQUE to between 135 and 150 lbf.in. (1.50 and 1.70 m.daN).
(7)Pressure test fuel tubes for leaks as follows :
(a)Introduce dry air, nitrogen or argon at a pressure of 200 psig (13.78 bars) through fuel supply line.
(b)Apply fluid (CO5-005) or soap solution to each connection.
(c)No leaks permitted.
(8)Connect fuel manifold shrouds to VBV actuator rod and head-end ports as follows :
(a)Slide shroud ferrules into position against face of actuator port bosses.
(b)Secure shroud ferrules with shroud nuts. Hand-tighten and safetywire.
CAUTION : ON ENGINES NOT EQUIPPED WITH VBV ROD END DRAIN TUBE, THE SHROUDED DRAIN CAN FITTING MUST REMAIN OPEN. DO NOT CAP DRAIN CAN FITTING.
(9)Connect drain tube to VBV head end fitting on shroud. TORQUE to between 270 and 300 lbf.in. (3.05 and 3.39 m.daN).
(10)Install liner segments and secure each with 4 screws. TORQUE screws to between 55 and 70 lbf.in. (0.6 and 0.8 m.daN).

D. Close-Up and Test
(1)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.
(2)Close thrust reverser and fan cowl doors (Ref. 71-13-00, P. Block 301). Remove safety clips and tags and close circuit breakers.
(3)Perform test as indicated in "Type of testing after engine component replacement" (Ref. 71-00-00, P. Block 501).



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Variable Bypass Valve Actuator
Figure 401

VARIABLE BYPASS VALVE ACTUATOR - ADJUSTMENT/TEST

1. General

This procedure pertains to the adjustment/test of the Variable Bypass Valve (VBV) Actuators.

2. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B. 2C6395	VSV Hydraulic Actuator
Referenced Procedure - 71-13-00, P. Block 301	Cowl Doors

3. Procedure

A. Job Set-Up

(1) Open, safety and tag the appropriate circuit breakers and open fan and thrust reverser cowl doors. (Ref. 71-13-00, P. Block 301).

B. Adjustment/Test

NOTE : Actuators may be pressurized by an external pressure source (step 1) or by motoring the engine (step 2). Pressurizing using an external pressure source is preferred.

(1) Piston seal cross leakage test of actuators using external pressure source.

(a) Place a container under main engine control (MEC) rod and head-end VBV CONNECTORS.

(b) Disconnect VBV actuator rod and head-end piping at the MEC. Install protective caps on fittings in the MEC.

(c) Connect rod end hose from hydraulic actuator (2C6395) to rod end tube.

CAUTION : DO NOT EXCEED 300 PSIG (20 bars) PRESSURE OR ENGINE PARTS MAY BE DAMAGED.

(d) Pressurize actuator rod end with pressure cart to 100 psig (7 bars).

(e) Maintain pressure of 100 psig (7 bars) for 5 minutes (or less if leakage rate is excessive) and measure leakage rate from head end piping using a graduated measure and a watch.

(f) Replace actuators if leakage rate exceeds 150 cc per minute.

NOTE : Since 2 actuators are being checked, the combined leakage from both is being measured. The combined leakage must not exceed 150 cc per minute, therefore, sufficient time must be given for the piping to both actuators to fill, if it is not full from previous engine operation.

NOTE : Individual actuator leakage may exceed 75 cc per minute, but the combined total shall not exceed 150 cc per minute.

(g) If no leakage occurs, reduce pressure to zero and disconnect the VBV rod end tube from the hydraulic actuator.

(h) Connect head end hose from hydraulic actuator (2C6395) to VBV head end tube.

CAUTION : DO NOT EXCEED 300 PSIG (20 BARS) PRESSURE OR ENGINE PARTS MAY

BE DAMAGED.

(i)Pressurize actuator head end tube to VBV with pressure cart to 100 psig (7 bars).

(j)Maintain pressure of 100 psig (7 bars) for 5 minutes (or less if leakage rate is excessive) and measure leakage rate from rod end piping using a graduated measure and a watch.

(k)Replace actuators if leakage rate exceeds 150cc per minute.

NOTE : Since 2 actuators are being checked, the combined leakage from both is being measured.
The combined leakage must not exceed 150 cc per minute, therefore, sufficient time must be given for the piping to both actuators to fill, if it is not full from previous engine operation.
Individual actuator leakage may exceed 75 cc per minute, but the combined total shall not exceed 150 cc per minute.

(l)If no leakage occurs reduce pressure to zero and disconnect the VBV head end tube from the hydraulic actuator.

(m)Connect VBV rod end tube to MEC and TORQUE to between 270 and 300 lbf. in. (3.05 and 3.39 m.daN).

(n)Connect VBV head end tube to MEC and TORQUE to between 450 and 550 lbf.in. (5.08 and 6.21 m.daN).

(2)Piston seal cross leakage test of actuators by motoring engine.

NOTE : Motoring of the engine to pressurize the actuators is not preferred. It is preferred that an external pressure source be used.

(a)Place a container under MEC rod and head-end VBV connectors.

(b)Disconnect VBV actuator rod-end piping at the MEC.
Install pressure cap on rod-end fitting in the MEC.

(c)Motor engine for 10 seconds, with a 20 second coastdown while collecting leakage from head-end piping.

(d)Replace actuators if total leakage for the 30 second period exceeds 75 cc.

(e)Remove pressure cap from rod end fitting on the MEC.

(f)Connect VBV rod end to MEC. TORQUE B nut to between 270 and 300 lbf.in. (3.05 and 3.39 m.daN).

C. Close-Up

(1)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.

(2)Remove safety clips and tags and close circuit breakers. Close thrust reverser and fan cowl doors (Ref. 71-13-00, P. Block 301).

VARIABLE BYPASS VALVE ACTUATOR - INSPECTION/CHECK

1. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
Referenced Procedure - 71-13-00, P. Block 301	Cowl Doors

2. Procedure

A. Job Set-Up

(1)Open, safety and tag the appropriate circuit breakers and open fan and thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).

B. Inspection/Check

INSPECT/CHECK	MAXIMUM SERVICEABLE LIMITS	REMARKS
(1)Fuel Leakage :		
(a)From end cap	Not serviceable	Replace actuator
(b)From overboard drain	90 cc per hour 1.5 cc per minute/ 35 drops per minute	Replace actuator
(2)Actuator Housing for :		
(a)Deformation, dents	Not serviceable	Replace actuator
(b)Nicks, scratches	Any amount not deforming housing	Replace actuator
(c)Loose coating	No loose coating or metal exposure is permitted	Repair per approved repairs
(3)Threaded Connectors for :		
(a)Stripped threads	Not serviceable	Replace actuator
(b)Nicks, dents in threads	Any amount not to complete depth of thread. No high metal allowed	Change threads or replace actuator
(4)Piston Rod for:		
(a)Scoring	Not serviceable	Replace actuator
(b)Bending	Not serviceable	Replace actuator
(c)Stripped threads	Not serviceable	Replace actuator

C. Close-Up

(1)Make certain that working area clean and clear of tools and miscellaneous items of equipment.

(2)Remove safety clips and tags and close circuit breakers. Close thrust reverser and fan cowl doors (Ref. 71-13-00, P. Block 301).

VARIABLE BYPASS VALVE ACTUATOR - APPROVED REPAIRS

1. General

This procedure describes the only approved repair that may be done on the VBV actuator at the line maintenance level. No other repairs are authorized.

2. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Access Platform
C.	Rotary Wire Brush
D. Material No.C01-049	Adhesives, Plastics, Sealants (Ref. 70-00-00)
E. Material No.C01-092	Adhesives, Plastics, Sealants (Ref. 70-00-00)
F. Material No.C03-023	Finishes and Protective Coatings (Ref. 70-00-00)
G. Material No.C04-004	Cleaning Compounds and Solvents (Ref. 70-00-00)
Referenced Procedures	
- 71-13-00, P. Block 301	Cowl Doors
- 75-32-01, P. Block 401	Variable Bypass Valve Actuator

3. Procedure

A. Job Set-Up

(1)Open, safety and tag the appropriate circuit breakers and open cowl doors (Ref. 71-13-00, P. Block 301).

(2)Install access platform.

(3)Remove variable bypass valve actuator (Ref. 75-32-01, P. Block 401).

B. Repair of Silicone Rubber Coating

CAUTION : AVOID DAMAGE TO ACTUATOR SURFACE.

(1)Remove all loose coating using a rotary wire brush.

WARNING : CLEANING SOLVENTS ARE HIGHLY FLAMMABLE, VOLATILE, AND TOXIC. THEY SHOULD BE USED WITH ADEQUATE VENTILATION. AVOID PROLONGED BREATHING OF VAPORS AND REPEATED OR PROLONGED CONTACT WITH THE SKIN.

(2)Clean area to be coated with trichloroethylene (C04-004), and wipe dry with clean cloth.

CAUTION : DO NOT APPLY RTV ON PORTS OR FLANGE MATING SURFACES. DO NOT COVER UP PORT NAMES.

(3)Prime surface to be coated with primer (C01-092).

(4)Coat prime surface with a mixture of compound (C01-049) and pigment (C03-023) using a spatula or spray gun to a minimum thickness of 0.040 in. (1.02 mm).

NOTE : Compound (C01-049) may be colored to match before application to tank by mixing black pigment (C03-023) into material until desired color is obtained.

(5)Air cure for 8 to 12 hours at room temperature.

C. Close-Up

(1)Install variable bypass valve actuator (Ref. 75-32-01, P. Block 401).

(2)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.

(3)Remove access platform.

(4)Close cowl doors, remove safety clips and tags and close the appropriate circuit breakers (Ref. 71-13-00, P. Block 301).

VARIABLE BYPASS VALVE FEEDBACK CABLE - REMOVAL/INSTALLATION

1. General

This procedure pertains to the removal and installation of the variable bypass valve (VBV) feedback cable. Access to the cable is obtained by opening the left side core cowl door.

2. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Torque Wrench 24-200 lbf. in. (0.27-2.26 m.daN)
Referenced Procedures	
- 71-00-00, P. Block 501	Power Plant - General
- 71-13-00, P. Block 301	Cowl Doors
- 73-21-01, P. Block 501	Main Engine Control (MEC)

3. Procedure

A. Job Set-Up

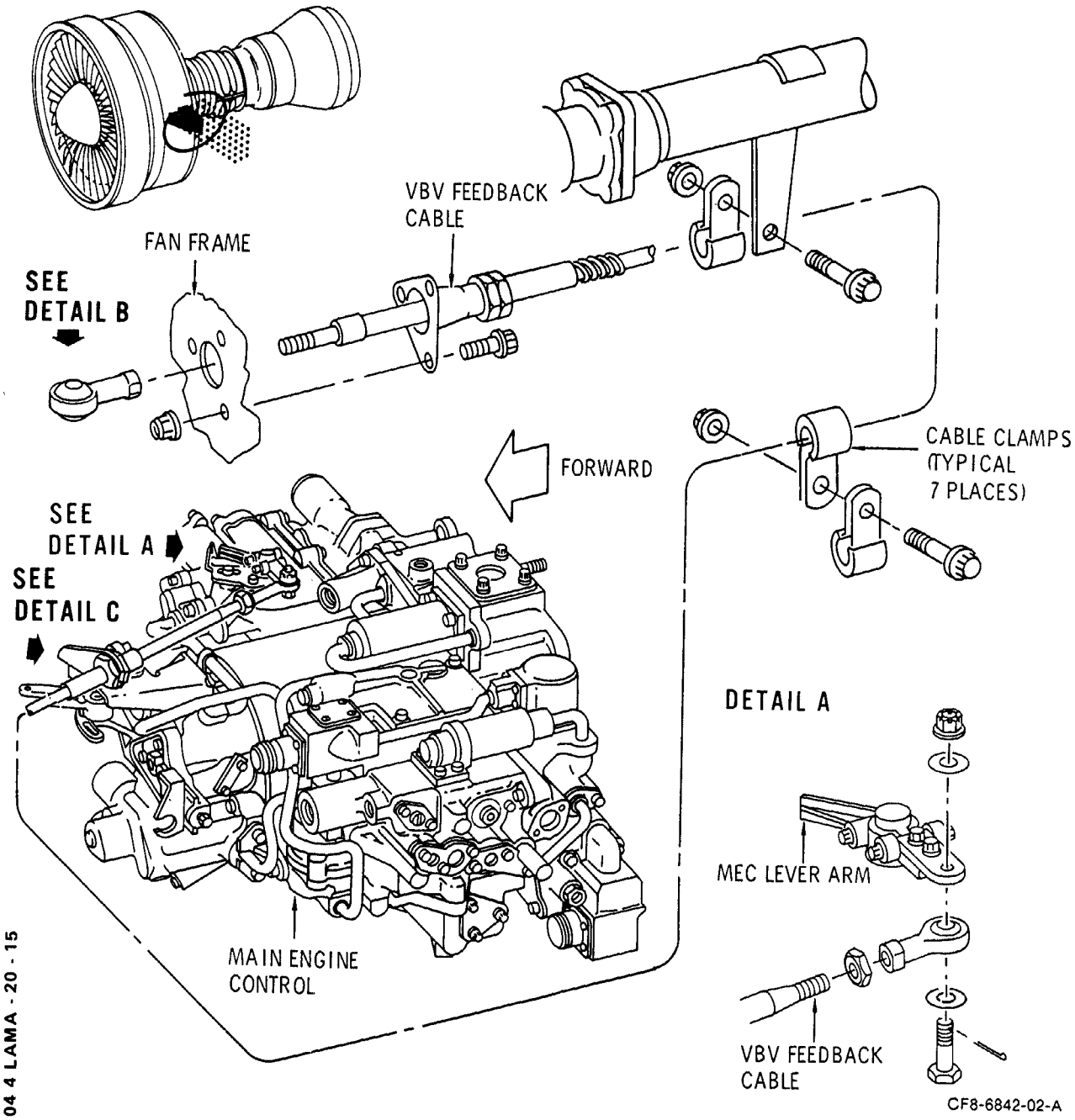
(1) Open, safety and tag the circuit breakers for the appropriate engine and open cowl doors (Ref. 71-13-00, P. Block 301).

B. Removal (Ref. Fig. 401)

(1) Remove clamps securing VBV feedback cable by removing nuts, bolts, and washers.
(2) Remove the inner flow path liner segment between struts 10 and 11 to gain access to the transducer end of the VBV cable by removing 4 screws.
(3) Remove lockwire and loosen jamnuts securing VBV cable rod-ends to VBV actuator and MEC lever arm.
(4) Disconnect VBV cable rod-end from VBV actuator bellcrank by removing nut, bolt, and washer.
(5) Disconnect VBV flange at fan frame bulkhead by removing the 3 nuts, bolts, and washers.
(6) Pull cable and rod-end through hole in bulkhead.
(7) Disconnect cable rod-end from MEC lever arm by removing cotter pin, nut, bolt, and washers.
(8) Remove lockwire and, using two wrenches, remove the nose cap and support tube assembly from cable.
(9) Carefully remove cable from trimmer bracket on MEC and then reinstall the nose cap and support tube assembly on cable fingertight.
(10) Remove cable rod-end bearings from cable. Count and record number of turns for ease of reinstallation.

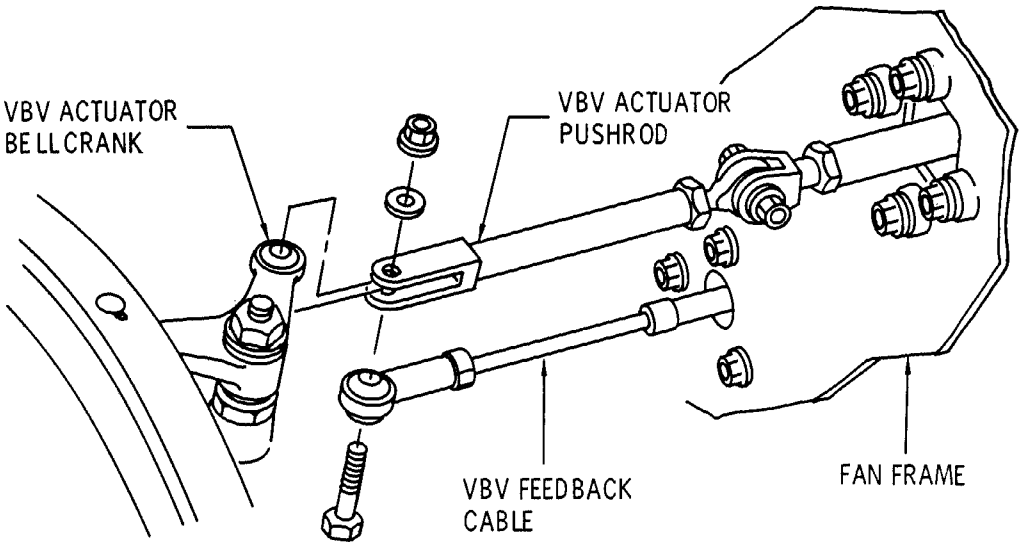
C. Installation (Ref. Fig. 401)

(1) Install jamnuts and rod-end bearings onto cable ends and thread onto cable the number of turns recorded in step 3.B.(10).
(2) Insert the forward end of feedback cable into the hole in aft fan frame.
(3) Temporarily attach VBV cable rod-end to Pactuator bellcrank with bolt,

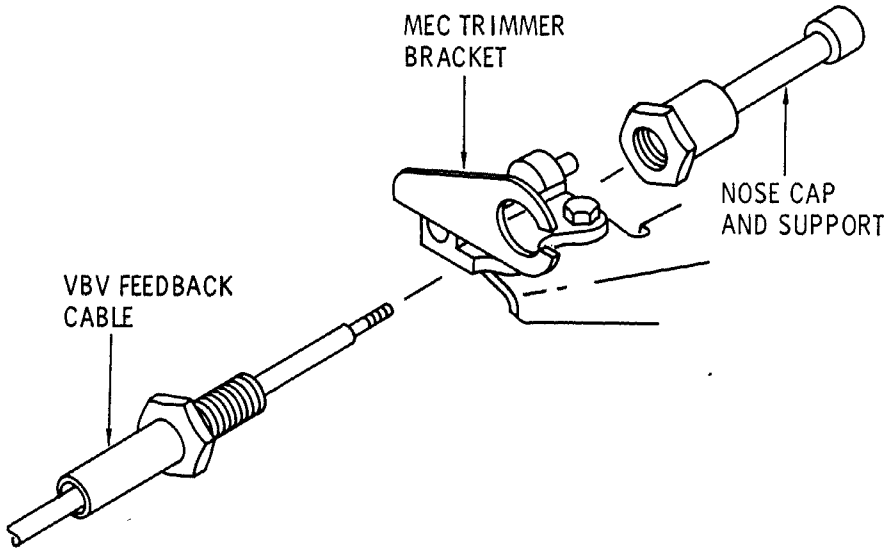


VBV Feedback Cable - Removal/Installation (Sheet 1 of 2)
Figure 401

DETAIL B



DETAIL C



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VBV Feedback Cable - Removal/Installation (Sheet 2 of 2)
Figure 401

washer, and nut.
(4)Secure cable flange to fan frame bulkhead with 3 bolts, washers, and nuts. TORQUE nuts to between 55 and 70 lbf. in. (0.62 and 0.79 m.daN).
(5)Install VBV cable in support trimmer bracket on MEC. Secure with support tube assembly and nose cap. TORQUE nose cap to between 180 and 200 lbf. in. (2.03 and 2.26 m.daN) and wirelock.
(6)Temporarily connect VBV cable to MEC lever arm using bolt, washer, and nut.
(7)Install clamps securing VBV feedback cable, and secure with bolts, washers, and nuts. TORQUE nuts to between 24 and 27 lbf. in. (0.27 and 0.31 m.daN).
(8)Rig system (Ref. 73-21-01, P. Block 501).

D. Close-Up and Test
(1)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.
(2)Close cowl doors (Ref. 71-13-00, P. Block 301). Remove safety clips and tags and close circuit breakers.
(3)Perform test as indicated in "Type of testing after engine component replacement" (Ref. 71-00-00, P. Block 501).

VARIABLE BYPASS VALVE FEEDBACK CABLE - ADJUSTMENT/TEST

1. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
Referenced Procedures	
- 71-13-00, P. Block 301	Cowl Doors
- 73-21-01, P. Block 501	Main Engine Control

2. Procedure

A. Job Set-Up

(1) Open, safety and tag the circuit breakers for the appropriate engine and open fan and thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).

B. Adjustment/Test

(1) Rig VBV feedback system (Ref. 73-21-01, P. Block 501).

(2) Check tube support as follows :

Band grasp and pull support tube at each end of feedback cable, pull in axial direction ; tube should not separate from base/cap of cable assembly : repeat above except rotate support tube. If support tube separates or rotates more than 45 degrees total, replace cable.

C. Close-Up

(1) Close thrust reverser and fan cowl doors (Ref. 71-13-00, P. Block 301). Remove safety clips and tags and close circuit breakers.

VARIABLE BYPASS VALVE FEEDBACK CABLE - INSPECTION/CHECK

1. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
Referenced Procedure - 71-13-00, P. Block 301	Cowl Doors

2. Procedure

A. Job Set-Up

(1)Open, safety and tag the appropriate circuit breakers and open fan and thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).

B. Inspection/Check

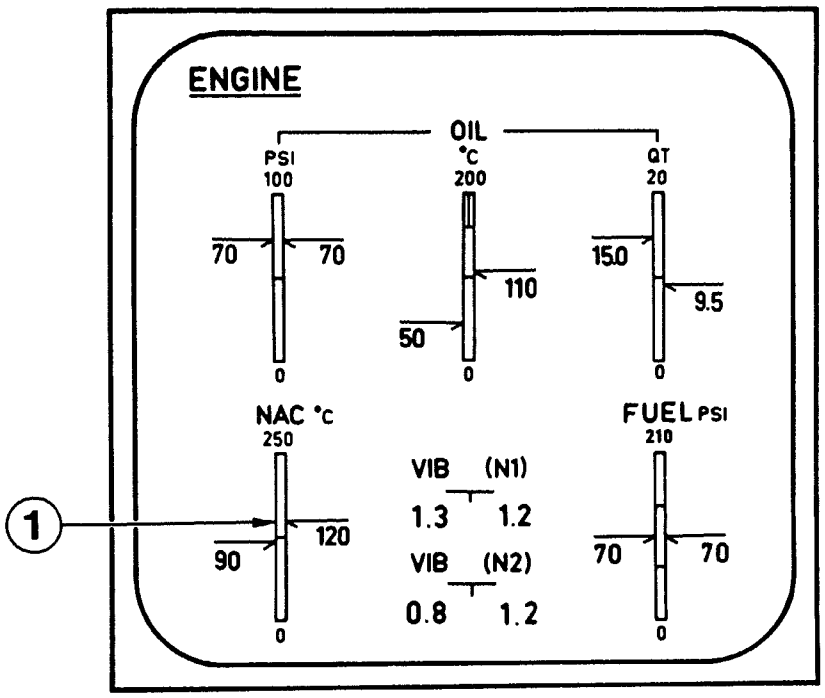
INSPECT/CHECK	MAXIMUM SERVICEABLE LIMITS	REMARKS
(1)Threaded Rod-Ends for :		
(a)Deformation or bends	Not serviceable	Replace cable assembly
(b)Rod-end uniball bearing for seizure or excessive looseness	Not serviceable	Replace rod-end bearing
(c)Scratched or damaged end fitting surface	Not serviceable	Replace cable arm
(2)Outer Conduit for :	Not serviceable	Replace cable assembly
(a)Wire strands broken or worn through		
(3)Support Tubes for :		
(a)Deformation, dents, or bends	Not serviceable if causing interference with inner member	Replace cable assembly
(4)Brackets and Clamps for :		
(a)Deformed, bend, or broken brackets	Not serviceable	Replace brackets
(b)Deformed or worn loop clamps	Not serviceable	Replace clamps

C. Close-Up

(1)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.
(2)Remove safety clips and tags and close circuit breakers. Close thrust reverser and fan cowl doors (Ref. 71-13-00, P. Block 301).

NACELLE TEMPERATURE INDICATING

1. General (Ref. Fig. 002)
   (Ref. Fig. 001)
   A nacelle exit temperature probe (resistance temperature device) shall be available as an accessory to measure core compartment exit temperature. The probe is located in the lower fan reverser vent path.
   It will indicate overtemperature resulting from loose or broken hot air ducts or from loose flanges, worn VSV bushing, etc...



1. NACELLE TEMPERATURE INDICATION FLASHES GREEN WHEN T > 185 C TAT
   * DURING ENGINE START REPLACED BY BLEED PRESSURE.

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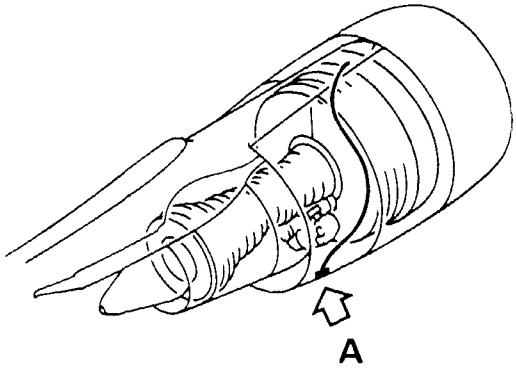
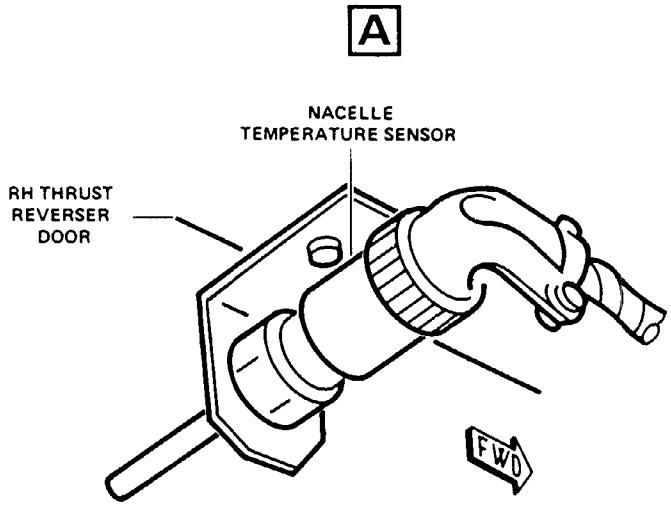
Engine Page on R ECAM Display Unit
Nacelle Temperature Indication
Figure 001





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Nacelle Temperature Sensor
Figure 002

NACELLE TEMPERATURE SENSOR - REMOVAL/INSTALLATION

1. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Torque Wrench 490 - 570 lbf.in. (5.54 - 6.44 m.daN)
Referenced Procedure - 71-13-00, P. Block 301	Cowl Doors

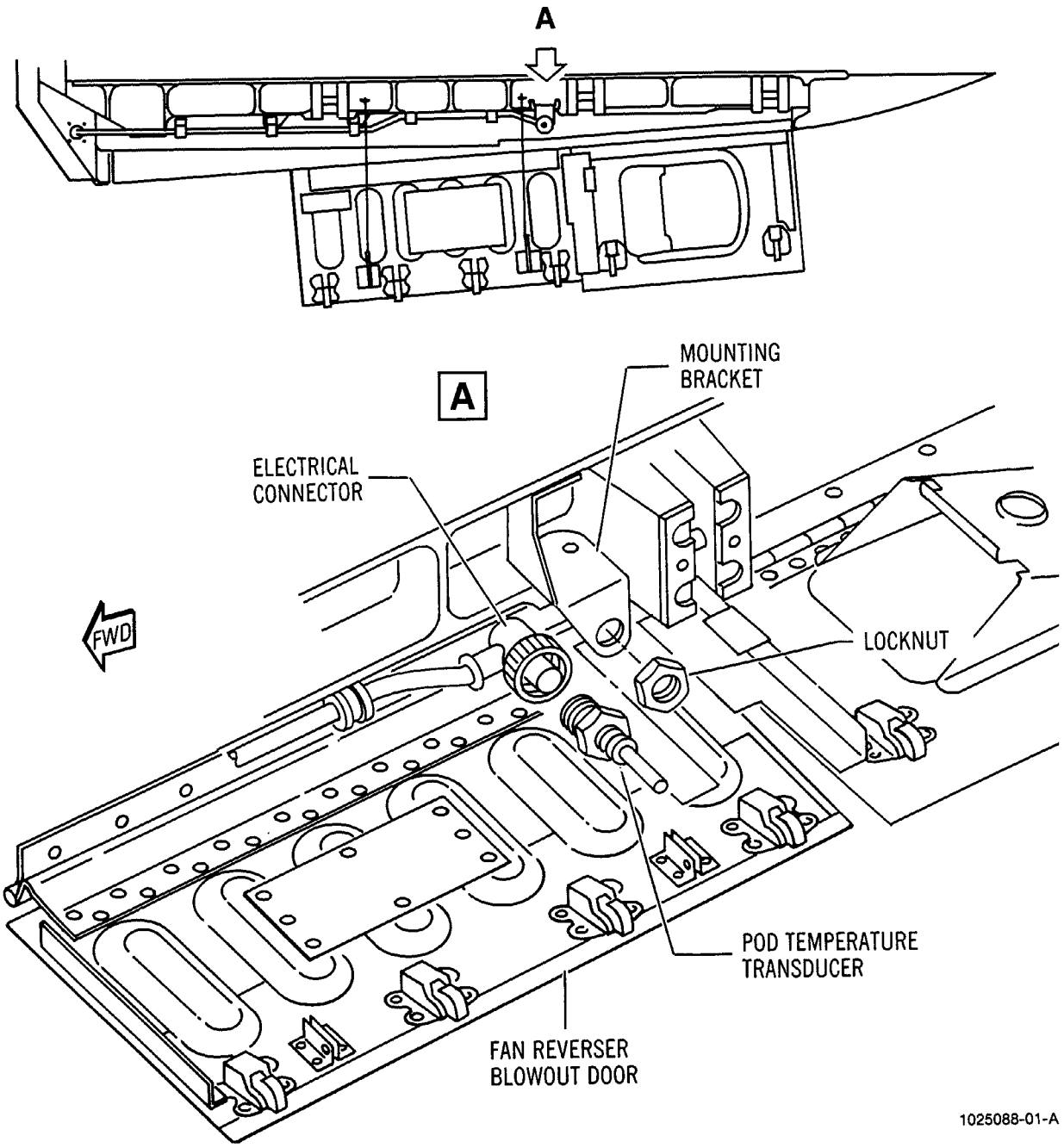
2. Procedure

A. Job Set-Up
(1)Open, safety and tag the appropriate circuit breakers and open fan and thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).

B. Removal (Ref. Fig. 401)
(1)Disconnect electrical connector.
(2)Remove locknut and release transducer from its mounting bracket.

C. Installation (Ref. Fig. 401)
(1)Position transducer in its mounting bracket and install locknut. TORQUE nut to between 490 and 570 lbf.in. (5.54 and 6.44 m.daN).
(2)Connect electrical connector. Hand tighten nut.

D. Close-Up
(1)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.
(2)Remove safety clips and tags and close circuit breakers. Close thrust reverser and fan cowl doors (Ref. 71-13-00, P. Block 301).



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Nacelle Temperature Sensor - Removal/Installation
Figure 401

NACELLE TEMPERATURE SENSOR - INSPECTION/CHECK

1. Visual Inspection/Check

A. Equipment and Materials

ITEM	DESIGNATION
(1)	Circuit Breaker Safety Clips
Referenced Procedures	
- 71-13-00, P. Block 301	Cowl Doors
- 75-41-01, P. Block 401	Nacelle Temperature Sensor

B. Procedure

(1)Job Set-up.

(a)Open, safety and tag the appropriate circuits breakers and open fan and thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).

(b)Remove sensor (Ref. 75-41-01, P. Block 401).

(2)Inspection/Check.

Visually inspect the following :

INSPECT/CHECK	MAXIMUM SERVICEABLE LIMITS	REMARKS
(a)Electrical Connector for :		
1 Insulator damage (cracks or chips)	Not serviceable	Replace transducer
2 Bent, broken or corroded pins	Not serviceable	Replace transducer
3 Distortion or out of round	Not serviceable	Replace transducer
4 Thread damage	Total of one full thread may be missing after chasing	Chase threads or replace transducer
(b)Probe for :		
1 Nicks, scratches or abrasions	Any number 0.005 in. (0.13 mm) deep and 0.10 in. (2.5 mm) long	Replace transducer
2 Cracks, splits or missing piece	Not serviceable	Replace transducer
3 Bends	Not serviceable	Do not attempt to straighten bent probes, replace transducer
(c)Body for :		

INSPECT/CHECK	MAXIMUM SERVICEABLE LIMITS	REMARKS
1 Cracks or distortion	Not serviceable	Replace transducer
2 Thread damage	30 percent on one entrance thread or 10 percent damage on each of two entrance threads	Blend repair
3 Rounded corners of hex head (wrench surfaces)	Acceptable if torque can be applied	Replace transducer
(d)Operational check	Must meet requirements of paragraph 2.	Replace transducer

(3)Close-up
(a)Install sensor (Ref. 75-41-01, P. Block 401).
(b)Remove safety clips and tags and close circuit breakers. Close thrust reverser and fan cowl doors (Ref. 71-13-00, P. Block 301).

2. Test

A. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Ohmmeter
C.	Megger, 100VDC
Referenced Procedures	
- 71-13-00, P. Block 301	Cowl Doors
- 75-41-01, P. Block 401	Nacelle Temperature Sensor

B. Procedure
(1)Job set-up
(a)Open, safety and tag the circuit breakers for the appropriate engine and open fan and thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).
(b)Remove sensor (Ref. 75-41-01, P. Block 401).
(2)Insulation resistance test
(a)Measure the insulation resistance between each connector pin and the case with a 100 VDC megger at room temperature.
(b)The insulation resistance shall be 50 megohms minimum.
NOTE : For this measurement, make sure no moisture is present on the sensor surface - especially between the pins and the case.
(3)Functional Resistance Test
(a)Immerse transducer in an agitated liquid bath up to the top of the attaching threads.

(b)Lower bath temperature to 32°F (0°C) and measure resistance between pins A and B. Resistance shall be 90.38 ± 0.40 ohms.
(c)Raise bath temperature to 212°F (100°C) and measure resistance between pins A and B. Resistance shall be 128.85 ± 0.50 ohms.
NOTE : If a complete checkout of the transducer is desired, check resistance at all points listed below.

(4)Transducer resistance check points

BATH TEMPERATURE (DEGREES CENTRIGRADE)	RESISTANCE - OHMS	TOLERANCE - OHMS
300	242.70	± 1.50
250	208.00	± 1.00
200	177.95	± 1.00
150	151.91	± 0.60
100	128.85	± 0.50
50	108.39	± 0.40
0	90.38	± 0.40
-20	83.77	± 0.40

(5)Close-up
(a)Install sensor (Ref. 75-41-01, P. Block 401).
(b)Remove safety clips and tags and close circuit breakers. Close thrust reverser and fan cowl doors (Ref. 71-13-00, P. Block 301).